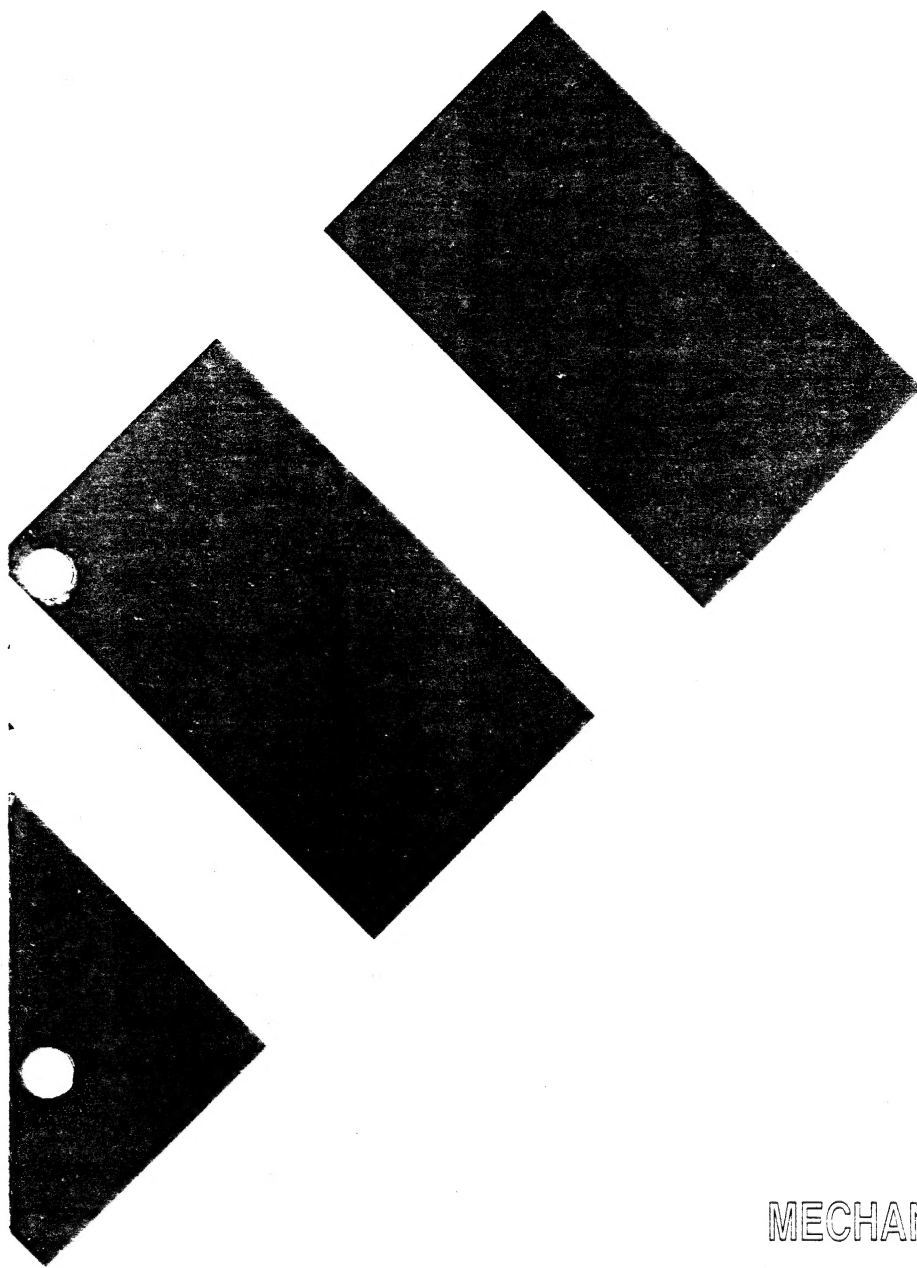


brother®

WORD PROCESSOR (WP-1 β SERIES) SERVICE MANUAL

MODEL:WP-2450DS



MECHANICS & ELECTRONICS

CHAPTER II THEORY OF OPERATION

GENERAL	9
1. PRINTING MECHANISM	10
1.1. Wheel Motor	10
1.2. Printing Hammer	11
2. RIBBON FEED MECHANISM	13
3. CORRECTION MECHANISM	14
4. CARRIER DRIVE MECHANISM	16
5. DAISY WHEEL RELEASE MECHANISM	17
5.1. Releasing the Daisy Wheel	17
5.2. Replacing the Daisy Wheel	17
6. PAPER FEED MECHANISM	18
7. PLATEN MECHANISM	19
8. PAPER RELEASE MECHANISM	20
9. COVER LEAF-SWITCH MECHANISM	21
10. KEYBOARD	22
11. CRT UNIT	23

**WORD PROCESSOR SERVICE MANUAL
(Mechanical Part)**

Contents

CHAPTER I SPECIFICATIONS

1. GENERAL DESCRIPTION	1
2. CONFIGURATION	2
3. SPECIFICATIONS	3
3.1. System Specifications	3
3.2. Printing Unit	4
3.3. Keyboard Unit	5
3.4. Monitor	5
3.5. Floppy Disk Drive (FDD)	5
4. POWER REQUIREMENTS	6
5. ENVIRONMENTAL CONDITIONS	7
6. DIMENSIONS AND WEIGHT	8

CHAPTER III MAINTENANCE

Precautions in Maintenance	24
SELF TEST	24
1. COVER	25
1.1. Boby Cover	25
1.1.1. Disassembly	25
1.1.2. Reassembly	26
1.1.3. Check and Adjustment	26
1.2. Top Cover	28
1.2.1. Disassembly	28
1.2.2. Reassembly	28
1.3. Handle	29
1.3.1. Disassembly	29
1.3.2. Reassembly	30
2. CPU PCB	31
2.1. Disassembly	31
2.2. Reassembly	31
2.3. Check and Adjustment	32
3. CHASSIS UNIT	33
3.1. Disassembly	33
3.2. Reassembly	35
3.3. Check and Adjustment	35
4. SPIRAL TUBE	36
4.1. Disassembly	36
4.2. Reassembly	37
4.3. Check and Adjustment	37
5. CARRIER DRIVE MOTOR	38
5.1. Disassembly	38
5.2. Reassembly	38
5.3. Check and Adjustment	38
6. DRIVE WIRE AND DRIVE PULLEY	39
6.1. Disassembly	39
6.2. Reassembly	39
6.3. Check and Adjustment	40
7. CARRIER DRIVE UNIT	41
7.1. Disassembly	41
7.2. Reassembly	41
7.3. Check and Adjustment	42
7.3.1. Fixing the drive wire	42
7.3.2. Adjustment of the carrier home position and correction pop-up	42
7.3.3. Adjustment of the daisy wheel home position lock arm	43
8. RIBBON CASSETTE SUPPORT ASSEMBLY	44
8.1. Disassembly	44
8.2. Reassembly	44
8.3. Check and Adjustment	45
8.3.1. Ribbon feed ratchet wheel	45
8.3.2. Correction wheel retaining ratchet	45

9.	HAMMER SUPPORT UNIT	46
9.1.	Disassembly	46
9.2.	Reassembly	46
9.3.	Check and Adjustment	47
9.3.1.	Adjustment of the hammer support assembly	47
9.3.2.	Adjustment of the printing position	48
9.3.3.	Adjustment of the gap between the daisy wheel spoke and the platen	49
10.	WHEEL MOTOR	50
10.1.	Disassembly	50
10.2.	Reassembly	51
10.3.	Check and Adjustment	51
10.3.1.	Wheel motor home position	51
11.	PAPER GUIDE	52
11.1.	Disassembly	52
11.2.	Reassembly	52
11.3.	Check and Adjustment	53
12.	CLUTCH ASSEMBLY	54
12.1.	Disassembly	54
12.2.	Reassembly	54
12.3.	Check and Adjustment	55
12.3.1.	Correction clutch	55
12.3.2.	Hammer clutch collar	55
12.3.3.	Adjustment of the position of hammer solenoid and correction solenoid	56
13.	PAPER FEED MOTOR	57
13.1.	Disassembly	57
13.2.	Reassembly	57
14.	FRONT PANEL	58
14.1.	Disassembly	58
14.2.	Reassembly	61
14.3.	Check and Adjustment	63
15.	SUB-CHASSIS AND FDD HOLDER	64
15.1.	Disassembly	64
15.2.	Reassembly	64
16.	CRT DISPLAY AND CRT PCB	65
16.1.	Disassembly	65
16.2.	Reassembly	67
16.3.	Check and Adjustment	68
16.3.1.	Fitting the CRT in the front panel	68
16.3.2.	Tools for adjustment of CRT display	69
16.3.3.	Adjustment of CRT	72
17.	FLOPPY DISK DRIVE (FDD) UNIT	81
17.1.	Disassembly	81
18.	FILTER PCB	83
18.1.	Disassembly	83
18.2.	Reassembly	83

19.	POWER CORD	85
19.1.	Disassembly	85
19.2.	Reassembly	85
20.	POWER SUPPLY PCB	86
20.1.	Disassembly	86
20.2.	Reassembly	86
21.	KEYBOARD UNIT	87
21.1.	Disassembly	87
21.2.	Reassembly	88
21.3.	Check and Adjustment	88
22.	FLEXIBLE PCB	89
22.1.	Disassembly	89
22.2.	Reassembly	90
22.3.	Check and Adjustment	90

CHAPTER IV LUBRICATION STANDARDS

1.	LUBRICANTS	91
2.	PRECAUTIONS	91
3.	LUBRICATION POINTS AND LUBRICANTS	92
3.1.	Keyboard	92
3.2.	Carrier Mechanism (1)	93
3.3.	Carrier Drive Mechanism (1)	96
3.4.	Platen Mechanism (1)	98

CHAPTER I SPECIFICATIONS

1. GENERAL DESCRIPTION

The WP-1β word processor is an all-in-one type compact word processor which incorporates a 5" x 9" CRT monitor and a 3.5" floppy disk drive.

Just pressing the TW/WP button switches the WP-1β to the electronic typewriter or word processor mode. The spelling check is also available with the English specifications.

The WP-1β uses a daisy wheel printing method to produce quality print-out at a speed of 15 characters per second at elite pitch, a snap-in ribbon cassette, and a correction tape for correcting mistyped characters.

2. CONFIGURATION

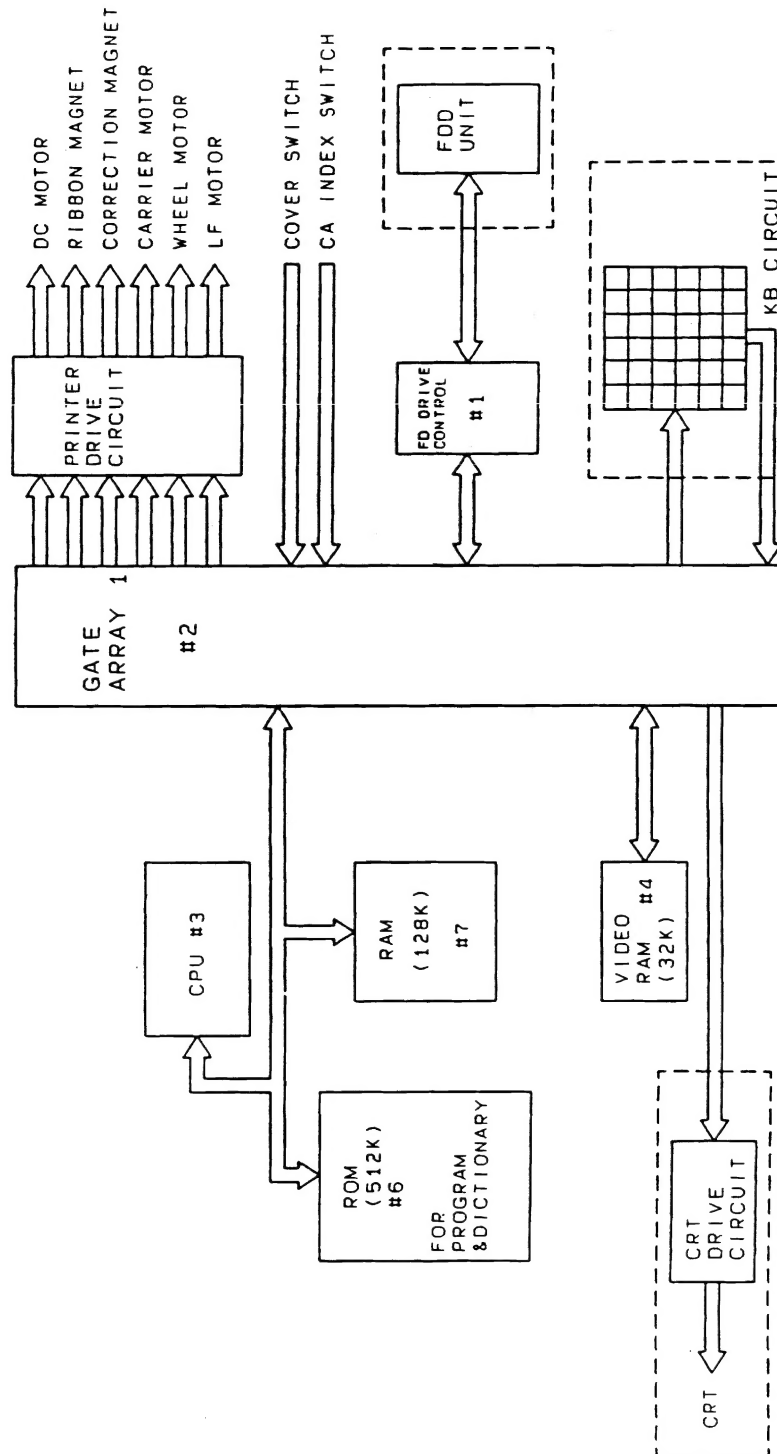


Fig. 2.1 Data Flow

3. SPECIFICATIONS

3.1. System Specifications

(1) System Mode	2 modes (word processing and typewriter)
(2) Printing Function	*Page print *File print
(3) Prompting Function	*Tutor program *Self-demo program
(4) Noise Level	63 dB max. A-Scale (Measured one meter away from the front of the word processor during character "H" printing.)
(5) Reliability	
Mean Time Between Failure (MTBF)	Min. 800 hours (Print duty: 20%)
Mean Time To Repair (MTTR)	Max. 30 minutes
Service Life	5 years or 10 million characters printing

3.2. Printing Unit

(1) Printing

Print Method	96-character daisy wheel in cartridge Mechanical hammer printing utilizing cam
Hammer Impact	2 levels
Print Speed	Min. 15 cps (Elite)
Print Pitch	1/10", 1/12", 1/15"
Daisy Wheel	
Type	Cartridge
Service Life	10,000,000 chars/wheel
Character Set	96 Chars/wheel
Font	Brougham as standard (Many types of fonts are optionally available, e.g., Prestige, Quadro, and Script.)
Printable Area	228.6 mm (9")
No. of Characters	90 chars (Pica pitch)
Per Line	108 chars (Elite pitch) 135 chars (1/15" pitch)
Print Direction	Unidirectional (in TYPE mode) Bidirectional logic seeking (in WP mode)
Copy Capacity	Original (45 Kg/ream) plus 4 copies (25 Kg/ream), including carbons
Character Alignment	Vertical : ± 0.06 mm max.
Error	Horizontal : ± 0.12 mm max.

(2) Paper Feeding

Paper Feed Method	Friction feed (cut forms)
Paper Feed Pitch	1/6" (Position 1) 1/4" (Position 1-1/2) 1/3" (Position 2)
Paper Feed Speed	1.5 ips
Forms	
Cut Forms Width	304.8 mm (12")

(3) Ribbon and Correction Tape Feeding

Ink Ribbon	
Ribbon Feed	Driven by ribbon feed motor
Type	Cassette
Service Life	Standard Ribbon
Correctable carbon film	50,000 chars
Fabric ribbon	500,000 chars
Color	Black (red, blue, brown and green for correctable ribbon only)
Correction tape	Open reel system

(4) Detection Functions

Carrier leaf switch
Cover leaf switch

3.3. Keyboard Unit

- | | |
|-------------------|----------------------------------|
| (1) Keying System | Conductive Rubber Contact System |
| (2) Rollover | Pseudo-N key rollover |
| (3) Key Top Shape | Sculptured |

3.4. Monitor

- | | |
|--------------------------------------|---|
| (1) CRT Screen | |
| Size | 5" x 9"
91 columns x 15 lines |
| Resolution | 819 x 240 dots |
| Display Area | 187 ± 3 mm (horizontal)
72 ± 3 mm (vertical) |
| Surface | Glare |
| (2) CRT Neck Size | 20 mm |
| (3) Mean Time Between Failure (MTBF) | Min. 50,000 hours |

3.5. Floppy Disk Drive (FDD)

- | | |
|-------------------------|---|
| (1) Size | 3.5" |
| (2) Recording Capacity | 1 M bit (before formatting)
720 K bytes (after formatting) |
| (3) Recording Density | 8717 BPI |
| (4) Track Density | 135 TPI |
| (5) Total No. of Tracks | 160 |
| (6) Recording Method | MFM |
| (7) Speed | 300 r.p.m. |
| (8) Applicable Disks | MF-2DD
*MF-2HD is not applicable. |

4. POWER REQUIREMENTS

(1) Source Voltage	
U.S.A	110 - 120 V (60 Hz)
(2) Power Consumption	
U.S.A.	0.55 A
(3) AC Line Noise	1 kV min. (Pulse duration 50, 200, 1,000 ns)
(4) Rush Current	50 A max.
(5) Instantaneous Power Outages	The typewriter will not malfunction with power outages of up to 1 cycle/50 - 60 Hz)
(6) Power Supply Cord	AC cord, approx. 2 m long
(7) Insulation Resistance	7 M Ω min.
(8) Dielectric Strength	3,750 V/min.

5. ENVIRONMENTAL CONDITIONS

(1) Temperature and Humidity

	Temperature	Humidity
Operating	5 to 40 °C	20 to 80 %
Storage	-20 to 60 °C	5 to 95 %
With no condensation		

(2) Vibration Resistance

Operating	0.1G max. will not interfere with the word processor operation.
Non-operating	1.5G max. will not affect the word processor.

(3) Shock Resistance

Packaged	Dropped from 60 cm on all 6 sides
----------	-----------------------------------

(4) Electrostatic Noise

5 kV max. shall not cause malfunction
7 kV max. shall not break elements.
(Measured with the capacitor method.)

6. DIMENSIONS AND WEIGHT

Dimensions
Weight

405 (W) X 188 (H) X 451 (D) mm
11 kg

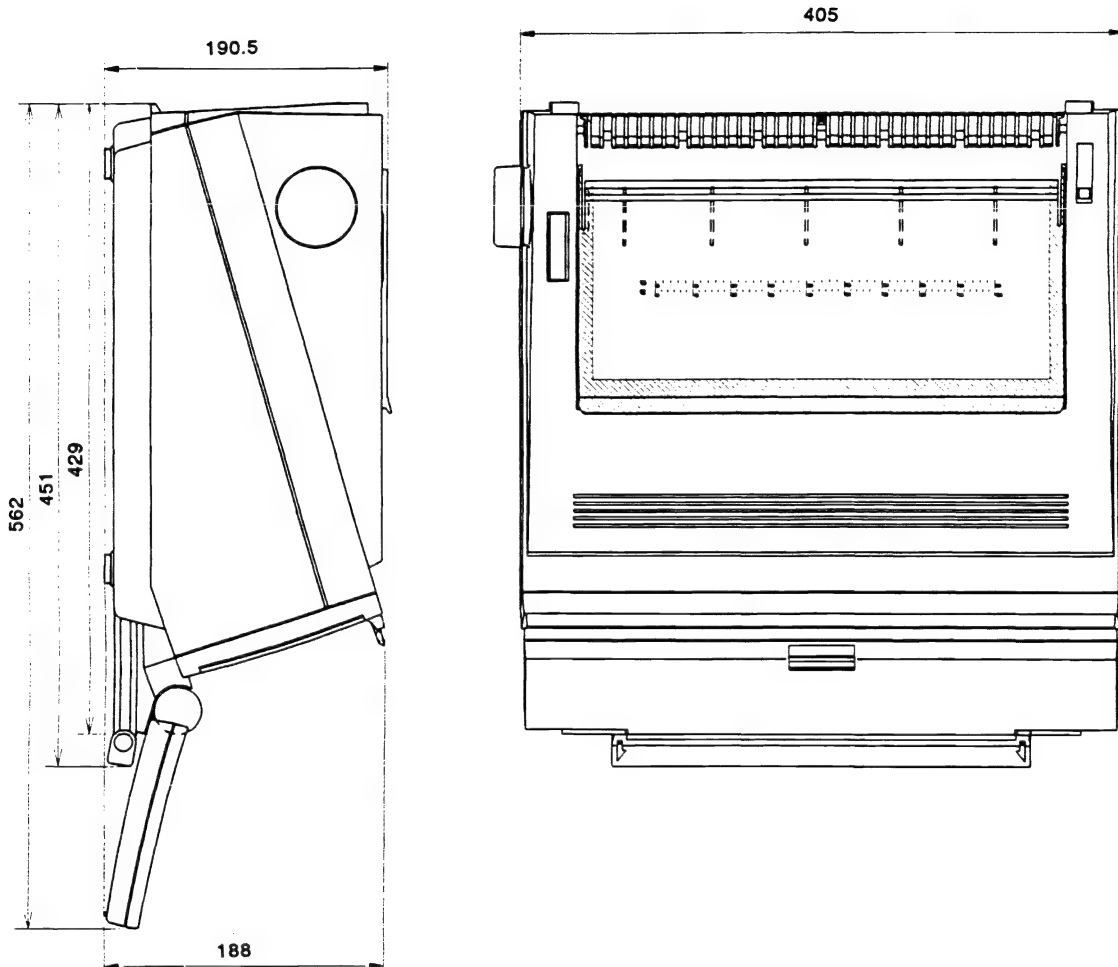


Fig. 6-A Dimensions

CHAPTER II THEORY OF OPERATION

GENERAL

The mechanism of the WP-1 β word processor can be divided into the following 3 units.

<Carrier Unit>

- Printing mechanism
- Ribbon feed mechanism
- Correction mechanism
- Carrier drive mechanism
- Paper guide unit
- Clutch assembly

<Paper Feed Unit>

- Paper feed mechanism
- Platen mechanism
- Paper release mechanism, Paper bail scale
- Auto paper insert mechanism

<Others>

- Cover switch
- Keyboard
- CRT
- FDD

1. PRINTING MECHANISM

The printing mechanism includes the wheel motor (stepping motor), which stops the daisy wheel (96 characters/wheel) at the selected character and the print hammer, which executes printing. The printing mechanism which is incorporated in the carrier frame moves from side to side, parallel to the platen.

1.1. Wheel Motor

The wheel motor is fastened to the wheel motor support by two screws. The daisy wheel cartridge release lever locks the daisy wheel to the wheel motor support and releases it for replacement. The wheel motor gear which is fitted on the wheel motor, engages the daisy wheel gear to turn the daisy wheel. The daisy wheel and daisy wheel subsidiary gear are mounted on the daisy wheel gear.

The home position of the wheel motor is indexed by the home position lock arm and the daisy wheel gear held to the wheel motor. At the wheel motor home position, the spoke for comma "," is selected on the daisy wheel.

Fig. 1.1 shows the daisy wheel gear and the wheel motor support as they are mounted on the carrier frame, and their relative dimensions.

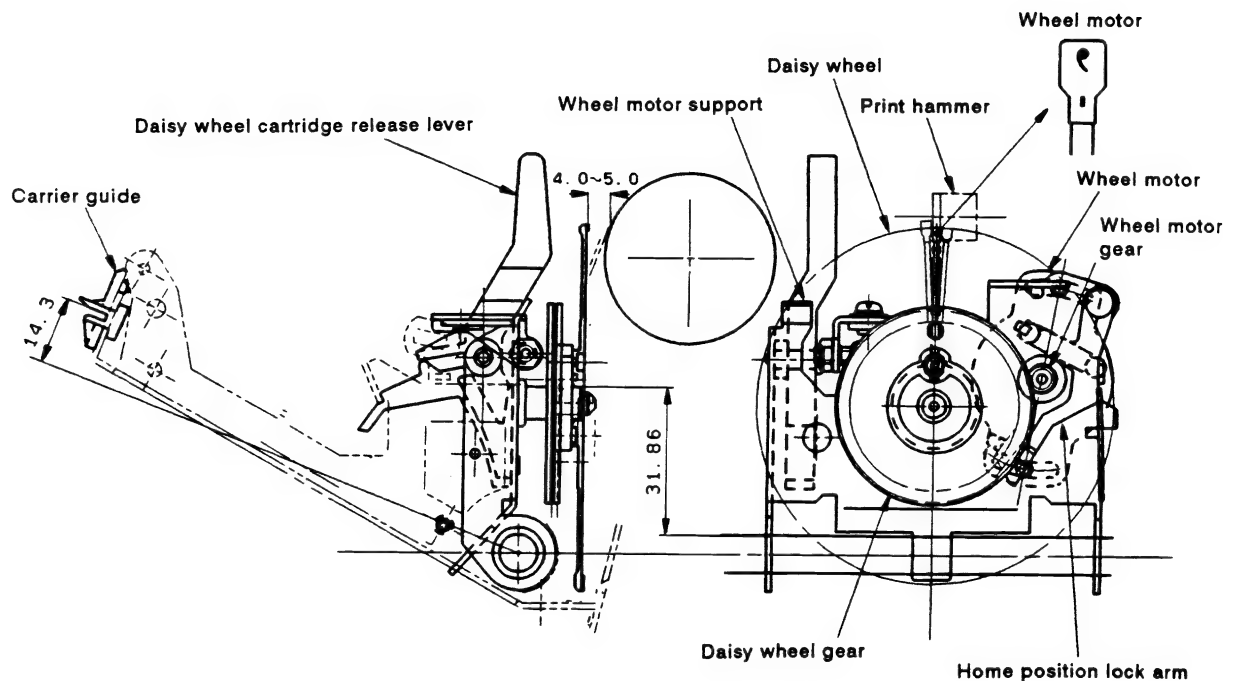


Fig. 1.1

1.2. Print Hammer

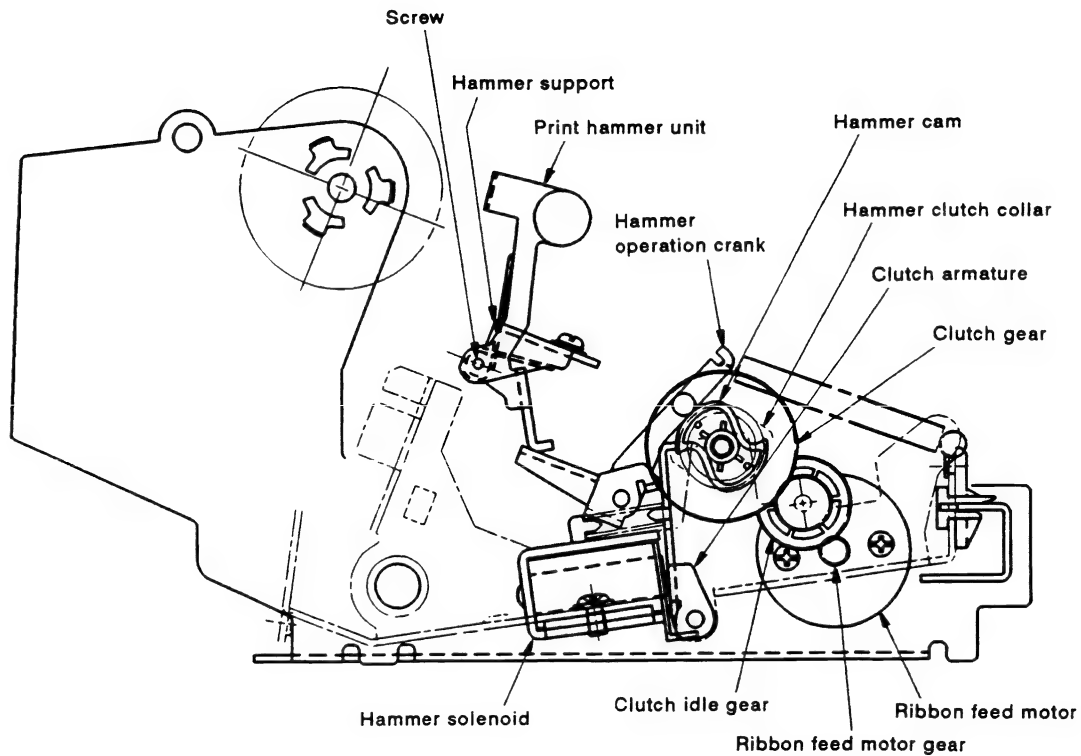


Fig. 1.2

The print hammer is fastened to the hammer support with a screw. The print hammer is driven by the (DC motor), causing it to strike the selected spoke at one of two possible hammer impact intensities. The hammer assembly functions as follows:

(1) Printing procedure

When a key on the keyboard is pressed, the DC motor rotates the ribbon feed motor gear which is press fitted to the motor shaft. The rotation of this gear is transmitted to the clutch gear via the clutch idle gear. Current flow to the hammer solenoid causes the solenoid to move the clutch armature which releases the hammer clutch collar. The released hammer clutch collar couples with the hammer cam via the hammer clutch spring and rotates with the clutch gear as a single unit. When current flow to the hammer solenoid stops, the clutch armature returns to its initial position.

(2) Hammer impact

The hammer cam has two cams; the hammer drive cam and the ribbon feed cam, and the hammer drive cam has stop position and operation position.

The hammer operation crank is pulled tight against the hammer drive cam by a spring, and moves back and forth according to hammer drive cam rotation.

When the hammer operation crank shaft drops off the hammer drive cam lobe, the hammer operation crank unit is moved backward into the cam's concave sections. This motion propels the print hammer up to strike the selected spoke.

One of two hammer impact intensities, weak or strong, is selected according to the size of the character. When the character has a large surface area, the printing operation described before, strikes the spoke with a strong impact. (See Fig. 1.3) When the character has a small surface area, the same operation in (1) takes place. The extended current flow causes the hammer solenoid to push the clutch armature back, which stops the hammer operation crank from swinging all the way back to its original position. This reduces its length of travel which reduces the impact strength to weak. See Fig. 1.4.

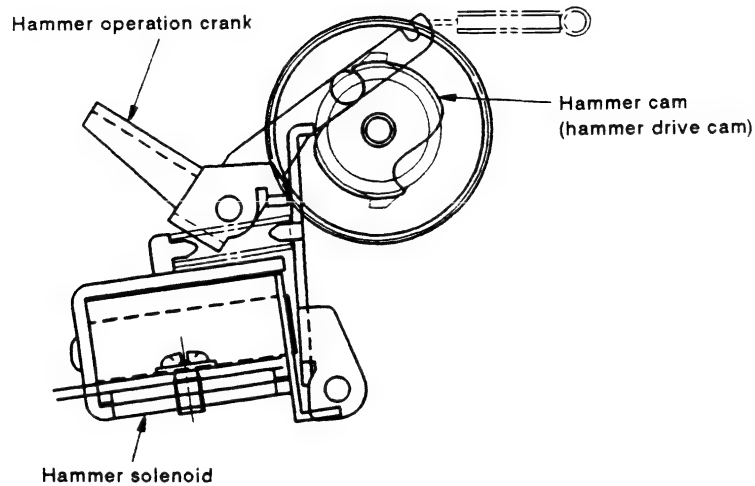


Fig. 1.3 Strong Impact Hammering

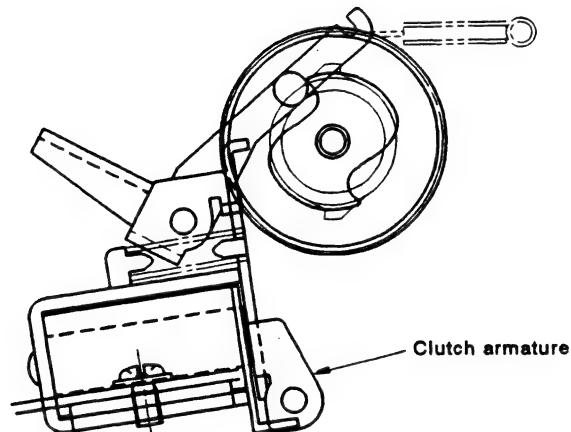


Fig. 1.4 Weak Impact Hammering

2. RIBBON FEED MECHANISM

Ribbon is fed simultaneously with the printing operation. It functions as follows:

- (1) The ribbon operation crank is pulled tight against the ribbon feed cam (hammer cam) by a spring. It moves back and forth according to ribbon feed cam rotation.
- (2) The ribbon operation crank pushes the ribbon feed crank which is fitted to the ribbon cassette support.
- (3) The ribbon feed crank rotates the ribbon feed ratchet wheel and the ribbon feed joint via the ribbon feed ratchet.
- (4) Each time the ribbon feed ratchet rotates the ribbon feed ratchet wheel by one tooth, the ribbon wheel retaining ratchet catches the ribbon feed ratchet wheel to prevent it from rotating in the reverse direction.
- (5) The rotation of the ribbon feed ratchet wheel is transmitted to the ribbon cassette to feed the ribbon.

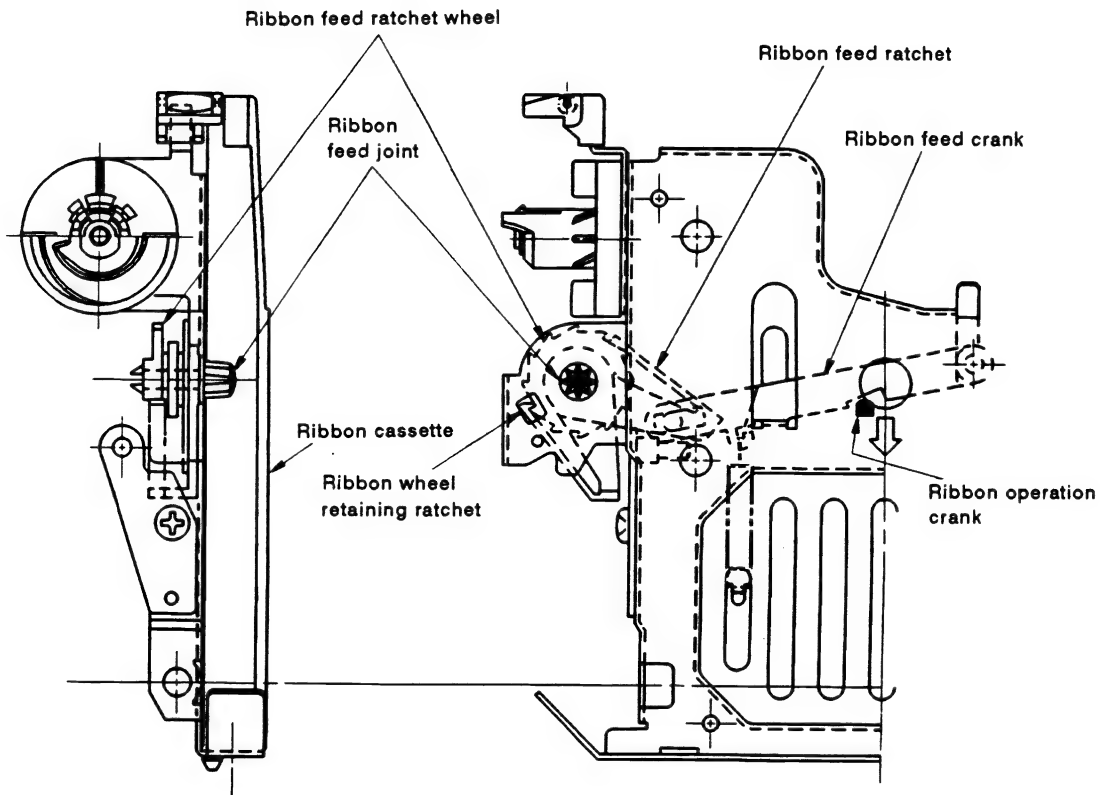


Fig. 2.1

3. CORRECTION MECHANISM

The correction mechanism is driven by the DC motor. This mechanism consists of the ribbon cassette lift mechanism which raises and lowers the ribbon cassette support unit, and the correction tape feed mechanism which feeds the correction tape.

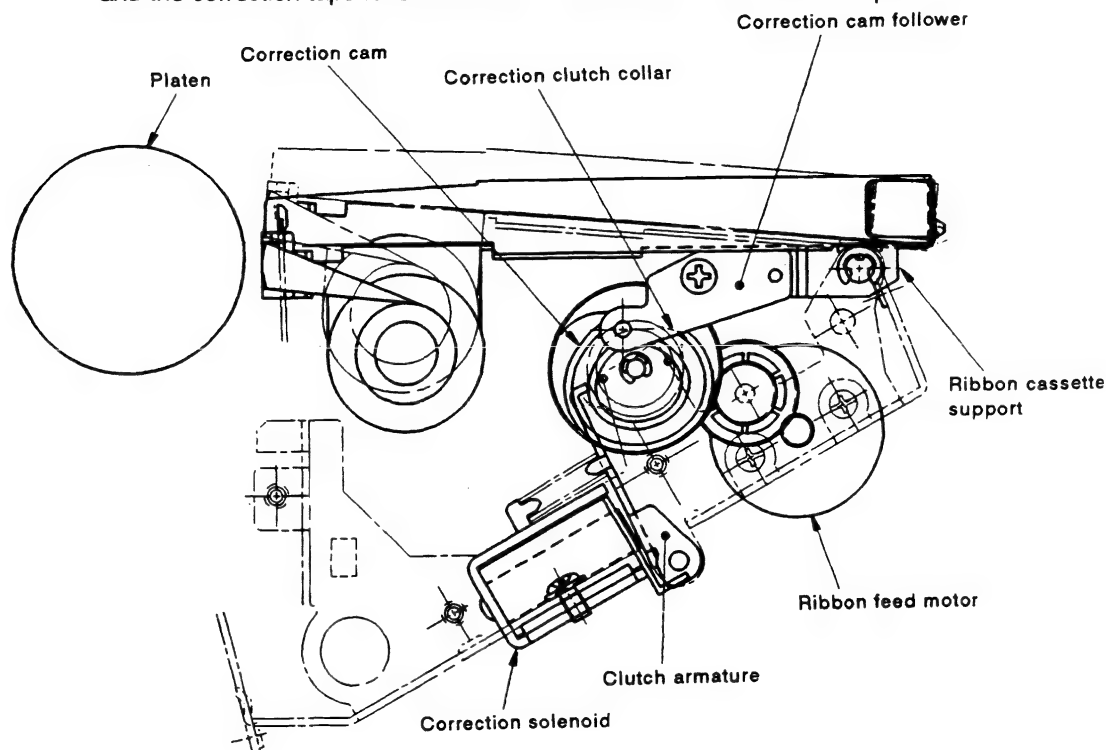


Fig. 3.1

The correction mechanism functions as follows:

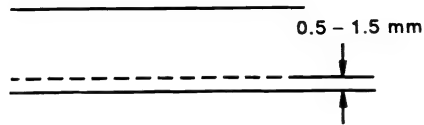
- (1) The wheel motor rotates the daisy wheel to select the character to be corrected.
- (2) The rotation of the DC motor is transmitted to the clutch gear (See "1.2 Print Hammer"). Current flow to the correction solenoid causes the solenoid to move the clutch armature which releases the correction clutch collar.

The released correction clutch collar couples with the collection cam via the correction clutch spring and rotates with the clutch gear as a single unit.

When the current flow to the correction solenoid stops, the clutch armature returns to its initial position and locks the correction clutch collar, stopping rotation of the gears.

- (3) The correction cam follower unit, which is mounted on the ribbon cassette support, has its shaft fitted in the groove of the correction cam. When the clutch collar rotates half a turn, the clutch armature stops the rotation. At this point, the correction cam follower unit fixed to the correction cam comes up to the apex of the cam and the ribbon cassette support is raised to its fully raised position, which brings the correction tape up to its printing position.
- (4) The hammer strikes the selected spoke four times against the correction tape to erase the printed character, while the ribbon cassette support remains at its raised position.

- (5) After the correction hammer has struck four times, current flows to the correction solenoid once more which causes the clutch armature, correction cam, and ribbon cassette support to return to their home positions.



NOTE: To check the vertical position of the correction tape, first print underlines " _ " with a correctable film ribbon. Then, erase underlines with a lift-off correction tape. The removed underlines should be 0.5 to 1.5 mm above the lower edge of the lift-off correction tape. If not, adjust the ribbon position by bending the correction tape guide at the front of the ribbon cassette support up or down (part (C) in Fig. 3.2)

- (6) The correction tape is fed by the vertical movement of the ribbon cassette support.

The shaft of the correction tape feed link is supported by the carrier frame, therefore, raising the ribbon cassette support moves the correction tape feed link in the direction indicated by arrow (A) shown in Fig. 3.2. The correction tape feed ratchet, connected to the correction tape feed link, is caused to move in the direction indicated by arrow (B) and catches the next tooth of the ratchet wheel. The correction wheel retaining ratchet prevents the ratchet wheel from rotating backward. When the ribbon cassette support is lowered, the correction tape feed ratchet rotates the ratchet wheel to wind up the correction tape.

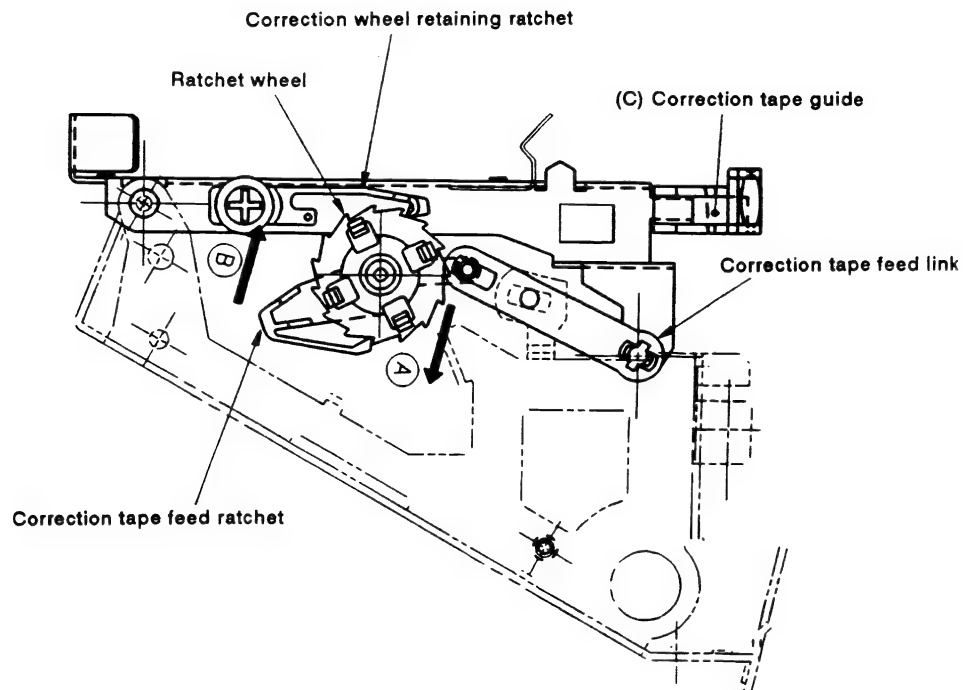


Fig. 3.2

4. CARRIER DRIVE MECHANISM

All operations involving the carrier movement, advancing the carrier to the right every time a character is printed, spacing, backspacing, return, or moving to a tab are driven by the carrier motor.

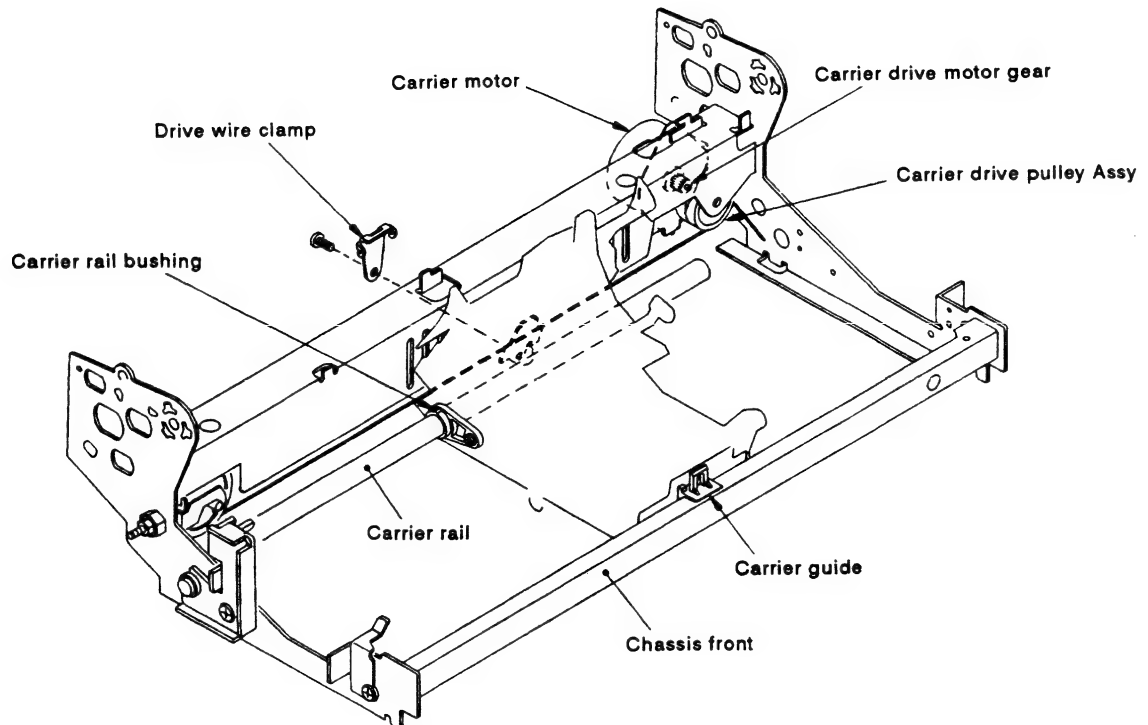


Fig. 4.1

The rotation of the carrier drive motor is transmitted to the carrier drive pulley assembly via the carrier drive motor gear. The drive wire is looped and tensioned between the carrier drive pulley assembly and the tension pulley mounted on the right and left chassis side plates, respectively.

The back of the carrier frame is supported by the bushings which glide along the carrier rail mounted between the left and right chassis side plates in the rear of the chassis. The front of the carrier mechanism is supported by the carrier guide which is fitted to, and moves along, the front of the chassis.

The drive wire is attached to the carrier frame by the drive wire clamp. The drive wire pulls the carrier frame from side to side according to how much and in which direction the carrier drive motor rotates.

The carrier drive pulley assembly consists of the carrier drive pulley main, carrier drive pulley sub, and carrier drive pulley spring.

Backlash between the carrier drive motor gear and the carrier drive pulley assembly is minimized by fitting the carrier drive pulley assembly sub to the carrier drive assembly main and spring tension pulling them away from each other.

5. DAISY WHEEL RELEASE MECHANISM

This mechanism is used to release the daisy wheel. The daisy wheel can be changed using the following procedure.

5.1. Releasing the Daisy Wheel

- (1) Open the top cover. The cover switch will be tripped and data input will be prohibited.
- (2) Pull the daisy wheel cartridge release lever towards the word processor front. The wheel motor support assembly will disengage from the carrier frame and swing towards the word processor front.
- (3) Disengaging the wheel motor support assembly causes the daisy wheel gear to disengage from the daisy wheel, releasing the daisy wheel.
- (4) Lift the daisy wheel cartridge up and take it out.

5.2. Replacing the Daisy Wheel

- (1) Insert the new daisy wheel cartridge between the ribbon guide and the daisy wheel gear, from above.
- (2) Push back the daisy wheel cartridge release lever to engage the wheel motor support and daisy wheel gear with the daisy wheel cartridge.
- (3) The head of the daisy wheel gear will be pushed to the opening of the daisy wheel by the force of the daisy wheel clamp spring, engaging the daisy wheel with the daisy wheel gear.
- (4) The wheel motor support assembly will be locked to the carrier frame by the daisy wheel cartridge release lever.
- (5) Close the top cover. The cover switch will be tripped to reset the word processor. The wheel motor starts to rotate the daisy wheel gear. The daisy wheel rotates with the daisy wheel gear until the daisy wheel pin strikes the daisy wheel pin stopper on the paper guide which stops the daisy wheel. The daisy wheel gear continues to spin. When the slot in the daisy wheel gear reaches the daisy wheel pin, which is stopped by the daisy wheel pin stopper, the pin is pushed into the daisy wheel gear by the spring force of the daisy wheel clamp. This securely engages the daisy wheel with the daisy wheel gear, and the two start to rotate together. The carrier moves to the left. When the wheel motor home position is indexed, the daisy wheel gear stops at that position once and then moves to the correct position. This makes it possible to select the correct character.

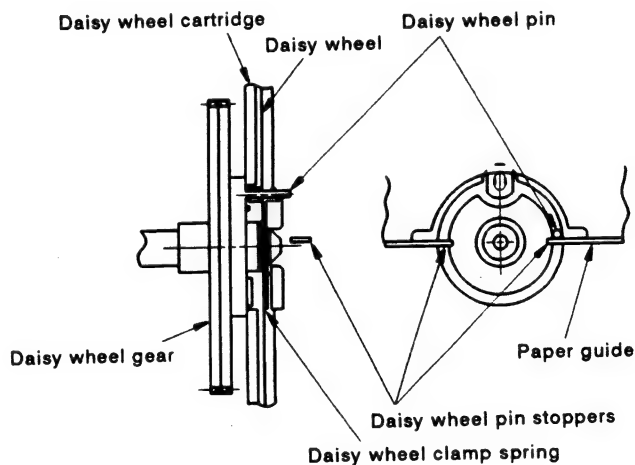


Fig. 5.1

6. PAPER FEED MECHANISM

- (1) The platen is driven by the paper feed motor (stepping motor).
- (2) The paper feed motor is attached to the paper feed motor holder with two screws. The paper feed motor holder is attached to the left chassis side plate so that it can freely rotate around a stepped screw. It is held in position by the coil spring.

The rotation of the paper feed motor is transmitted to the paper feed idle gear and then on to the paper feed gear. Backlash is minimized due to the spring tension constantly pulling them apart from each other.

- (3) Line spacing of 1, 1/2, or 2, (1/6", 1/4", 1/3") is available. A line space of 1/12" is also available by pressing the CODE + P UP or CODE + P DOWN key, respectively.

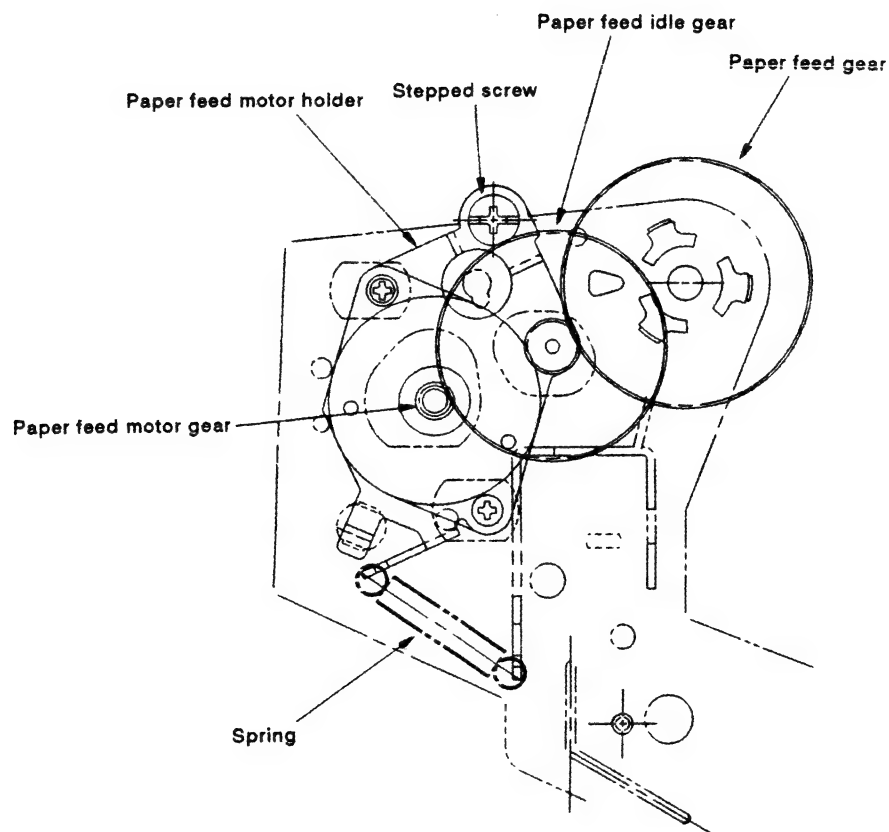


Fig. 6.1 Paper Feed Mechanism

7. PLATEN MECHANISM

Fig. 7.1 shows the platen mechanism. The rotation of the paper feed motor is transmitted to the paper feed gear to drive the platen. See "6. PAPER FEED MECHANISM."

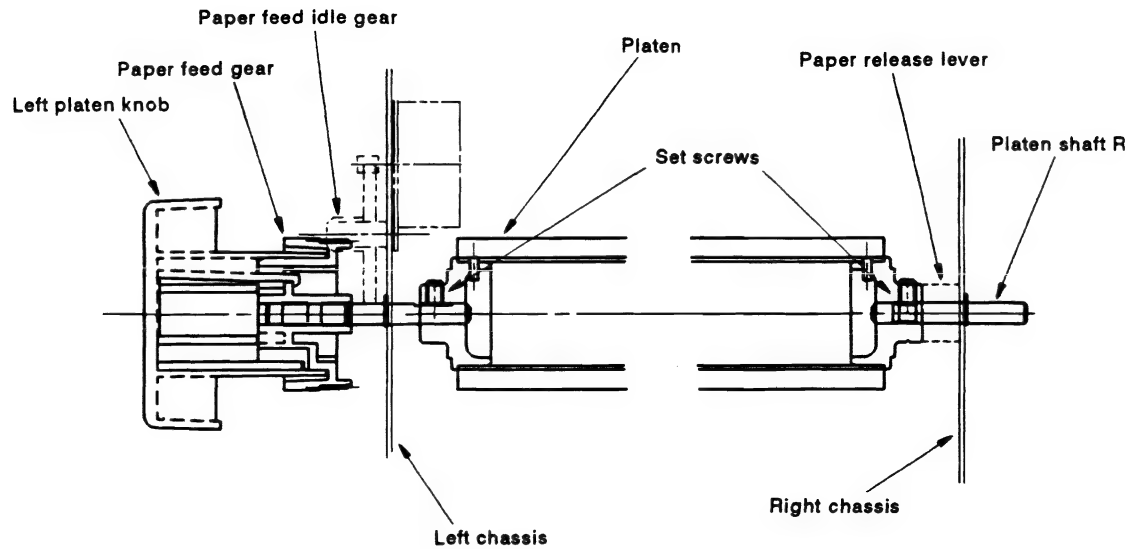


Fig. 7.1

NOTE1: Make sure that the two set screws are tightened so no gap is allowed between the right end face of the platen shaft, the paper release lever and the right platen shaft.

NOTE2: The shaft of the left paper feed gear has a flat surface at one end. Make sure that the set screw on it is tightened.

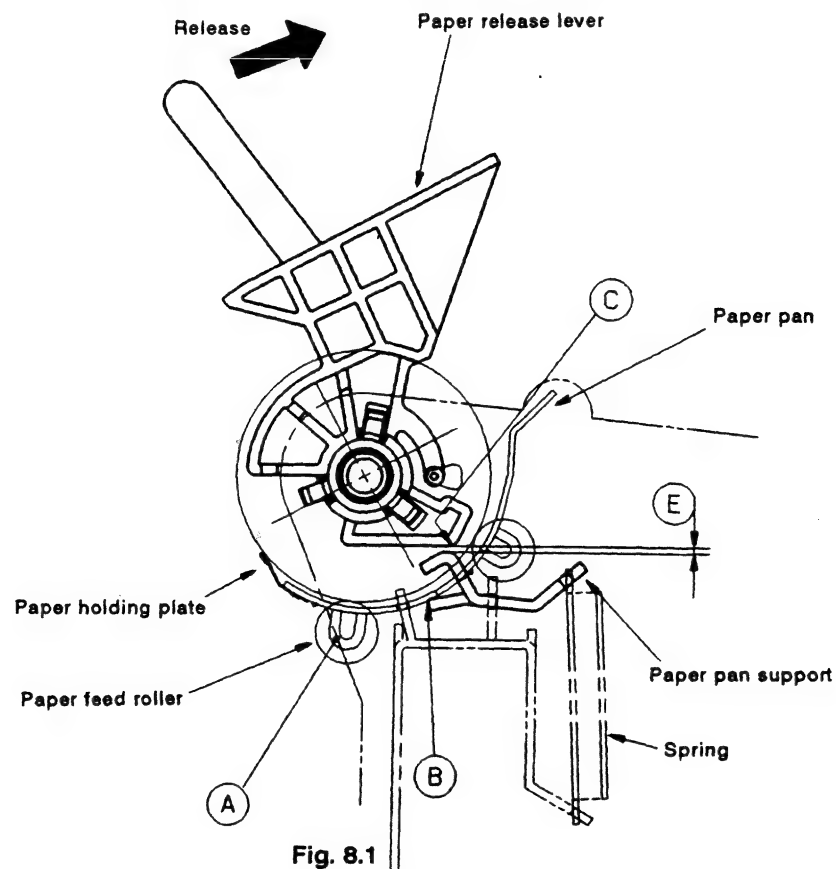
NOTE3: When fitting the paper feed gear, insert the paper feed gear shaft until its snap ring contacts the left chassis side plate while paying attention not to damage the teeth of the paper feed gear and the paper feed idle gear since the paper feed motor holder is pulled down by a spring force.

8. PAPER RELEASE MECHANISM

The paper is sandwiched between the platen and the paper feed rollers. It advances as the platen rotates. Make sure that both right and left paper feed rollers rest on the platen with equal pressure. If the pressure is not even, adjust by bending part (A) of the paper pan in which the paper feed roller shaft is inserted. (See Fig. 8.1). The paper feed rollers are pressed against the platen by the paper pan. The paper pan is raised into position by part (B), by spring pressure.

Paper releasing

To move the paper to any desired position, push back the paper release lever. Part (C) of the paper release lever will press down the paper pan support to make a space between the platen and the paper feed rollers. To make sure sufficient spaces have been made, insert and slide around all of the following papers as single, thick pack.



High quality paper	1 sheet
Typing paper	4 sheets
Carbon paper	4 sheets
<hr/>	
Total	9 sheets

NOTE: Also make sure there is a gap at (E) when the paper release lever has been pushed to the engaged position.

9. COVER LEAF-SWITCH MECHANISM

To ensure safety, when the top cover is opened to replace the daisy wheel, ribbon, etc., the cover leaf-switch is tripped and the main CPU resets all the drive mechanisms. This is sensed by the ON/OFF signal from the cover leaf switch when the top cover is opened and closed. Input data from the keyboard is shut off, and excitation of the carrier motor assembly, wheel motor, etc. are stopped. The main CPU is not reset, and the margin and tabulation settings are stored in the word processor memory.

After the top cover is closed, the word processor performs a series of indexing operations to allow data input from the keyboard. When the top cover is closed with the power on, the following operations take place.

- (1) The ribbon feed motor rotates and indexes the home position of the ribbon feed mechanism.
- (2) The carrier motor assembly moves to the left until the carrier index switch detects the carrier home position and turns on.
- (3) The wheel motor rotates to rotate the daisy wheel gear back and forth until the daisy wheel engages with the daisy wheel gear in its correct position.
- (4) The paper feed motor rotates to take up any backlash between the paper feed motor gear and the paper feed idle gear.

Then, by a tabulation operation, the carrier moves to the position it was at when the top cover was opened. On completion of above, data input from the keyboard is now accepted.

10. KEYBOARD

Key tops and key stems are assembled in the keyboard upper cover. The base plate secures the rubber spring and the keyboard PCB.

The rubber contact is a rubber part with a conductive rubber sponge and is glued onto the keyboard PCB. The FPC board is a single sheet of film (FPC) on which an electrode pattern is printed in layers. When the key top is pressed down, the key stem presses the rubber contact; the contact part (conductive part) connects both of the electrodes to output the predetermined signal for each key.

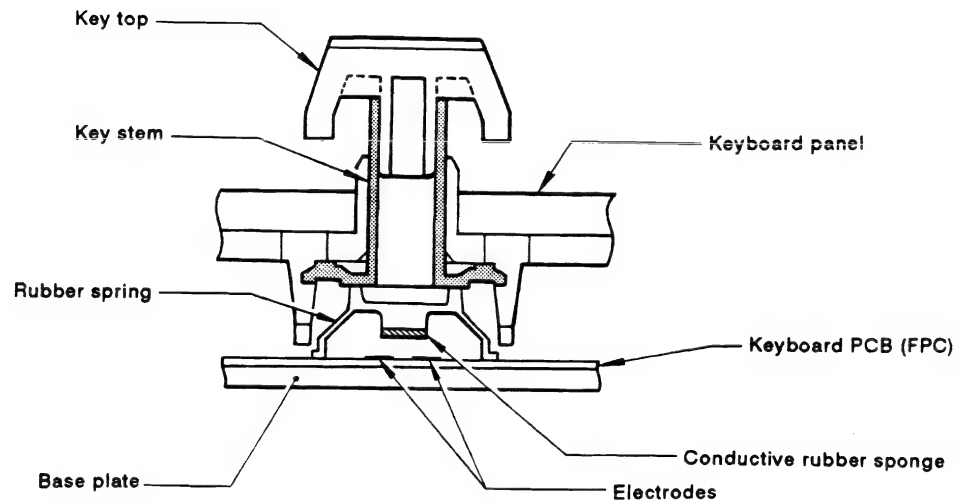


Fig. 10.1

11. CRT UNIT

The CRT unit is mounted in the front panel, and is capable of displaying 91 characters by 15 lines of text.

11 lines with 90 columns of pica type characters can be displayed. In the elite and micron modes, 108 columns by 11 lines, and 135 columns by 11 lines, respectively, can be displayed on the screen using horizontal scrolling.

In addition, the brightness of the CRT screen can be adjusted by the brightness control knob.

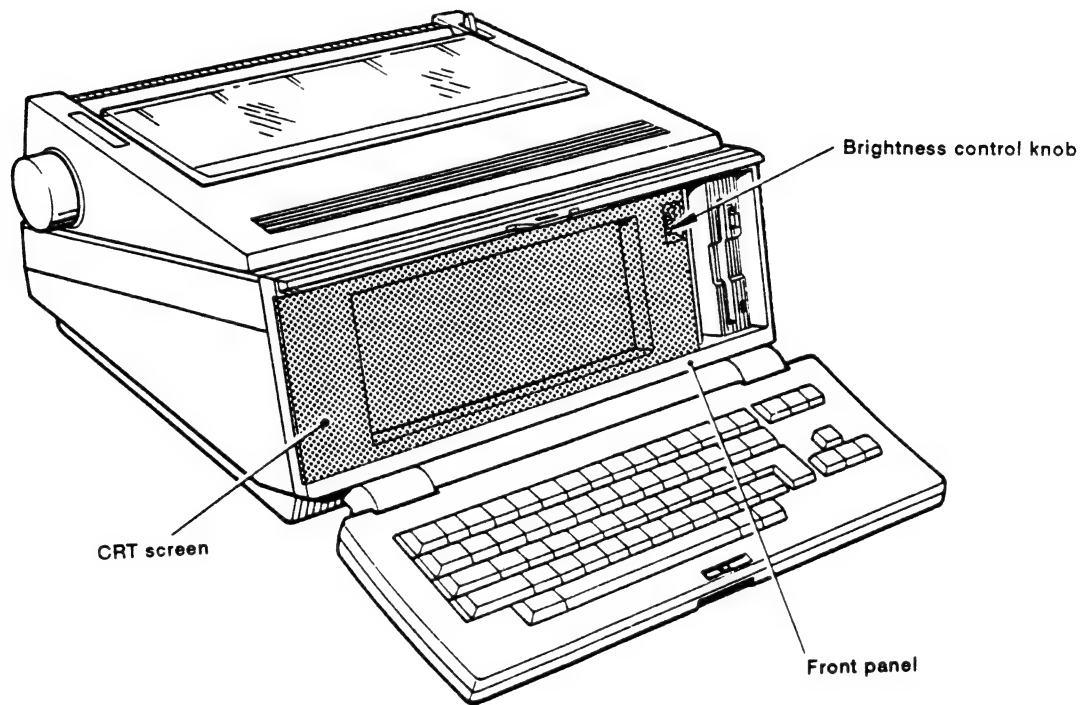


Fig. 11.1

Precautions in Maintenance

- (1) Turn off power when replacing parts or units. When replacing power supply related parts, pull the power plug out of the receptacle to make sure that the power is off.
- (2) Be careful not to lose any screws, washers, or other small parts when parts are being replaced.
- (3) Be sure to reinsert the tapping screws correctly after removing them.
- (4) When cable connectors are disconnected, hold the center of the connector itself. If the connector has a lock mechanism, be sure to unlock it first.
- (5) When replacing a PCB, be sure to touch by hand the metallic parts of the machine to discharge any residual static electricity in your body. A residual static charge on the human body could damage the sensitive electronic components.
- (6) Wrap PCBs in electrically conductive sheets such as aluminum foil before carrying them anywhere.
- (7) After repairs, check all connectors and other parts for looseness or missing parts, not only the part that was repaired, but for all parts. Then conduct a trial operation and check if the cause of the trouble has been removed.
- (8) Do not bring any magnet or magnetically charged object near the CRT unit.
- (9) Because the CRT and CRT PCB have parts of high voltages, there might be electric shocks when repairing the CRT, even after the power is off. Use an alignment screwdriver for adjustments to prevent electric shocks. (See "16.3.2 Tools for adjustment of CRT display".)

The WP-1 β incorporates the self test program as the standard.

For detail, refer to (1) self test in 16.3.2 Tools for adjustment of CRT display.

Select "5" (PRINTER) on the menu screen to print the following characters and erase the characters indicated by wavy lines.

ABCDEFGHIJKLMNOPQRSTUVWXYZ ° ! @ # \$ % & * () _ + [: " , . ? < π > § ¨ ¢
abcdefghijklmnopqrstuvwxyz ± 1 2 3 4 5 6 7 8 9 0 - = ½] ; ' , . /

,Kf&cJ6+Le,Kf&cJ6+Le

HAHBHCHDHEHFHGHIGHJHKLHMHNLHOHPHQHRHSHTHUHVHWHXHYHZH

FGHMW

THE QUICK Correction

13

20

$\text{II II II II II II II II II II II II II II II}$ $\frac{\quad}{9} \overset{3\ 3}{pp}__$

↑

Correction

WP-1 β Self Test Print Check Pattern

The carrier moves to the center of the "I" printed field after correction.

1. COVER

1.1. Body Cover

1.1.1. Disassembly

- (1) Turn off power and unplug the power cord.
- (2) Remove the platen knob

Open the body cover and unscrew the screw securing the knob on the left side of the platen. Place the paper release lever at the release position and remove the platen knob.

Since the left platen knob is simply inserted into the paper feed gear, it is removed easily, removal of it could cause damage, so its removal should be avoided unless absolutely necessary.

- (3) Remove the screw securing the cover
 - a) While flexing the paper support by pushing it against one side, remove the paper support by disengaging the projection on one side of the paper support from the hole on one side of the body cover, then, disengage the one on the opposite side.
 - b) Two screws are located at the rear of the body cover inside the power cord storage compartment. Unscrew all these screws.
- (4) Remove the body cover
 - a) While spreading the cover leaf switch unit on the body cover from the inside, push the switch down and take it out of the body cover.
 - b) In order to disengage the three projections on the body cover front from the front panel, raise the rear body cover to the front and lift it up. (Fig. 1.2)

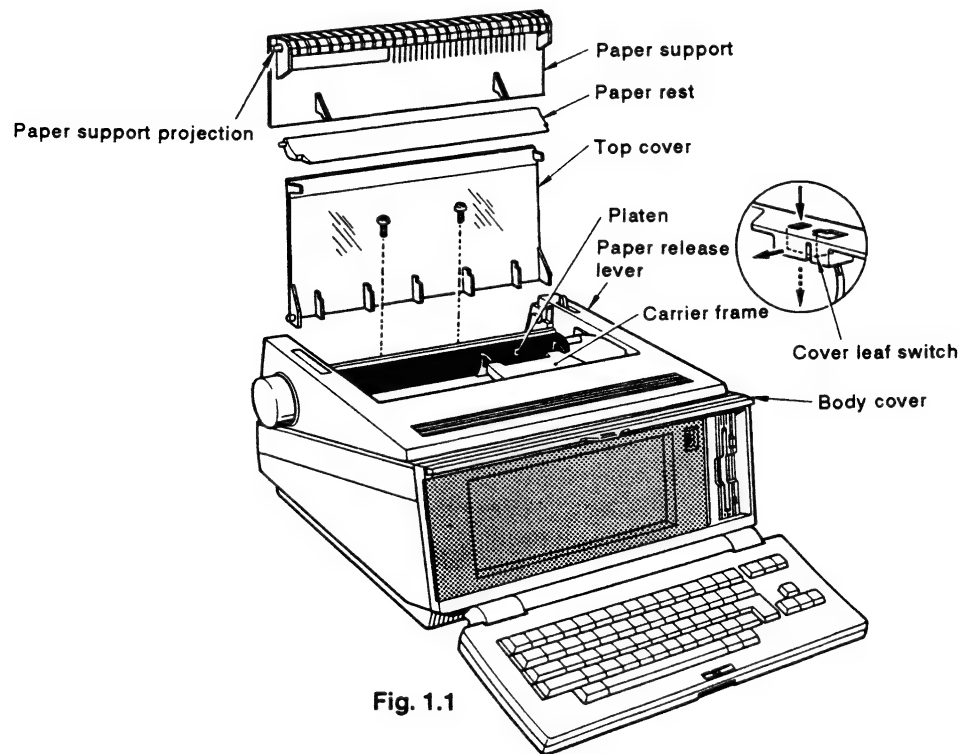


Fig. 1.1

1.1.2. Reassembly

To reassemble the body cover, reverse the order of disassembly

In order to prevent the power cord from pinching between the body cover and the bottom cover during reassembly, engage the power cord to the dent on the body cover.

Refer to "CHAPTER II. THEORY OF OPERATION" and precautions in "7. PLATEN MECHANISM."

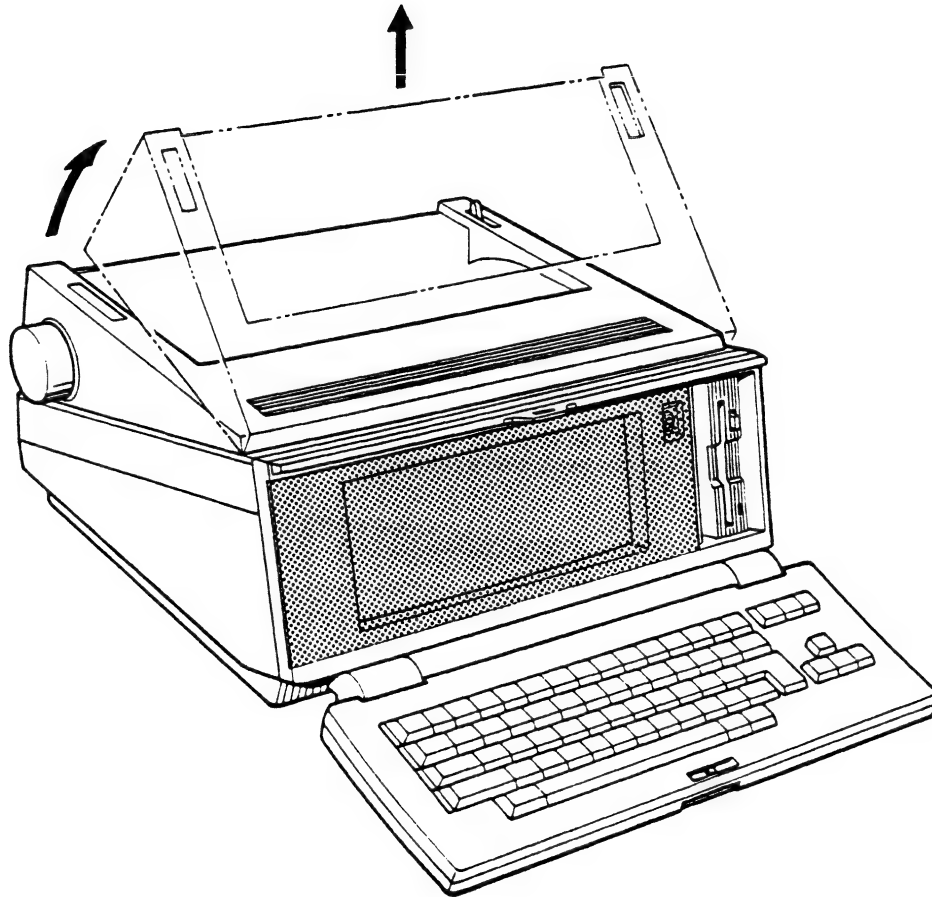


Fig. 1.2

1.1.3. Check and Adjustment

(1) Body cover

Make sure that the body cover, the bottom cover, and the front panel are securely engaged with each other with no gap between them.

(2) Platen

Make sure that the platen rotates smoothly.

(3) Paper release

Make sure that the paper release lever operates smoothly.

(4) Cover leaf switch

The gap between the point where the cover leaf switch is tripped ON by the top cover and the point when the top cover is completely closed (dimension (A)) should be 1 mm or greater. If the prescribed value cannot be met due to deformation, etc., check how the cover leaf switch is set, then adjust it.

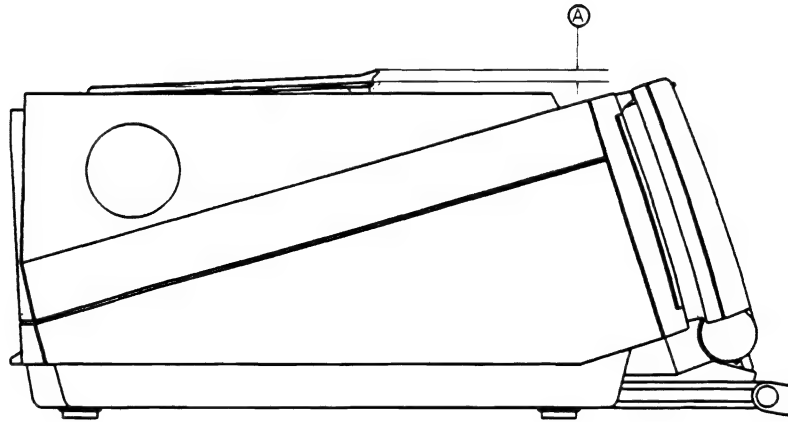


Fig. 1.3

1.2. Top Cover

1.2.1. Disassembly

- (1) Release the top cover front end lock to free the top cover.
- (2) While pressing the arm at the rear end of the top cover, slide the top cover to one side to remove it.

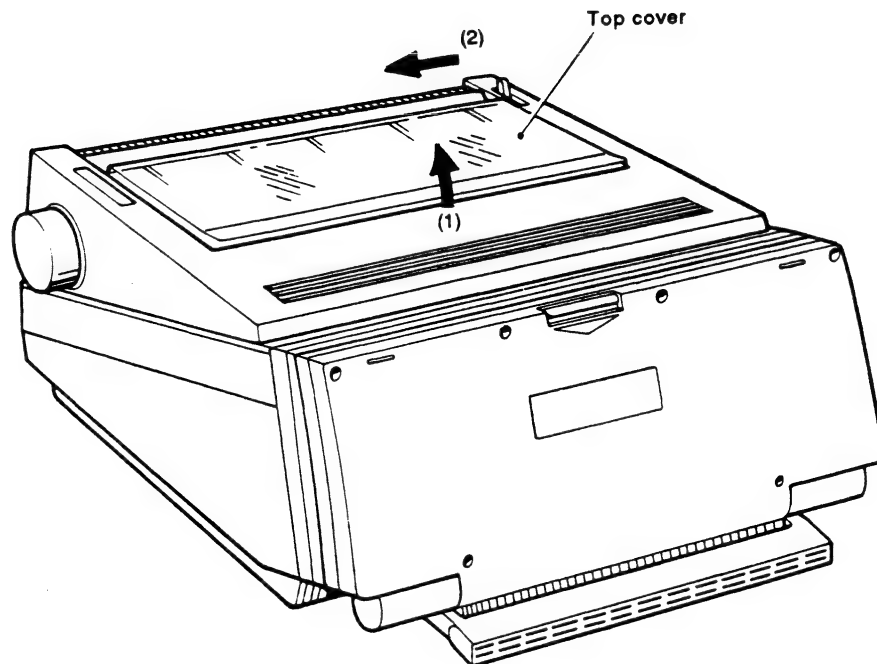


Fig. 1.4

1.2.2. Reassembly

To reassemble the top cover, reverse the order of disassembly.

1.3. Handle

1.3.1. Disassembly

- (1) Place the machine upright.
- (2) Hold the handle and place it on the handle stopper of the bottom cover in the manner as illustrated.

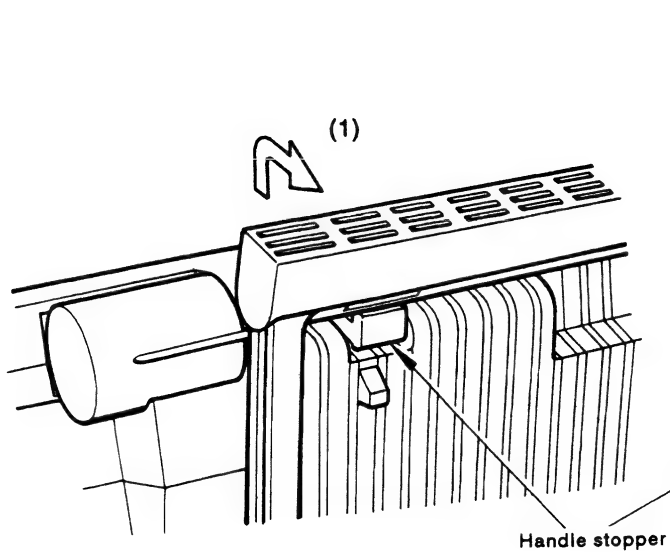


Fig. 1.5

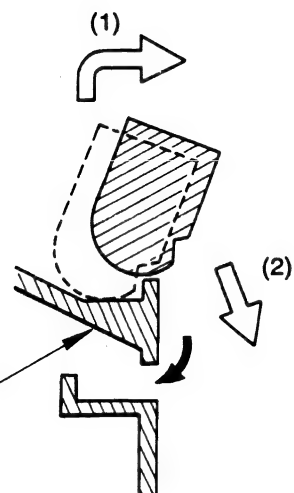


Fig. 1.6

- (3) Hold the both ends of the handle by hands and by pressing it to bend a little so that it can pass over the handle stopper.

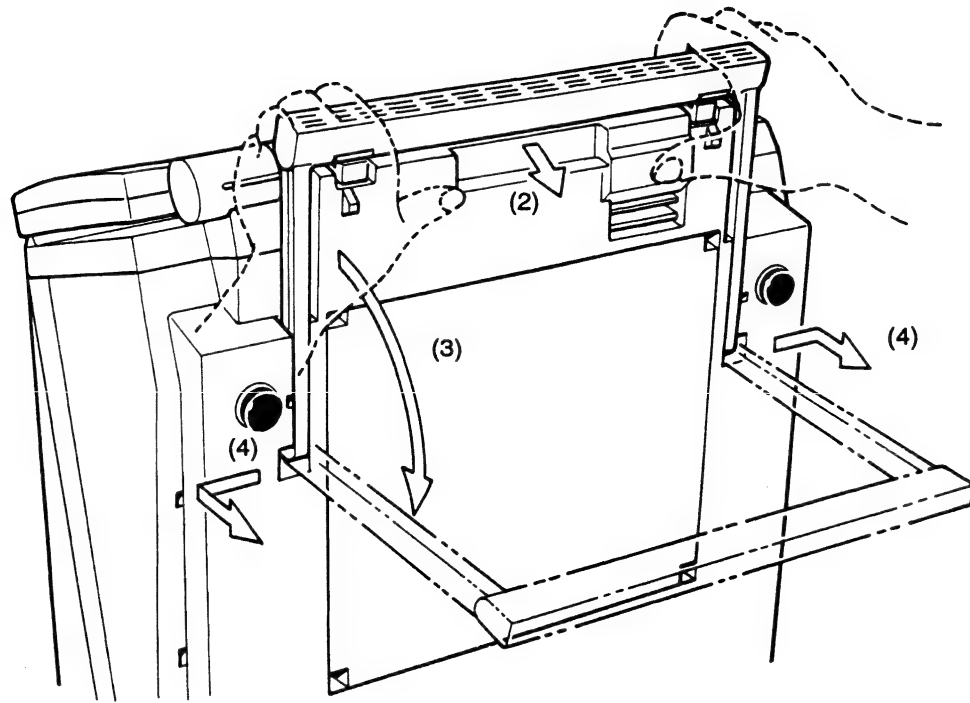


Fig. 1.7

- (4) Turn the handle to the horizontal position as indicated by arrow (3) and open the handle hooks out as illustrated by arrows (4) to remove the handle from the machine.

1.3.2. Reassembly

To reassemble the handle, reverse the order of disassembly.

2. CPU PCB

2.1. Disassembly

(1) Removal of the bottom plate

- a) Place the machine with its rear side facing down.
- b) Unscrew the four screws securing the bottom plate for removal.

(2) Removal of the CPU PCB

- a) Pull the top of the CPU PCB slightly forward, then remove the Flexible PCB.

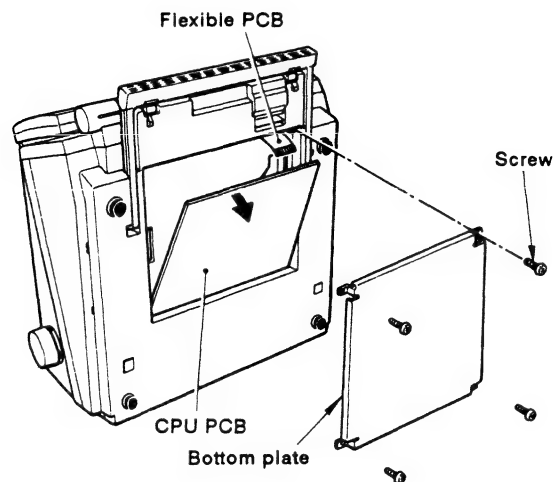


Fig. 2.1

- b) Set the CPU PCB down level, then disconnect all the connectors attached to it.

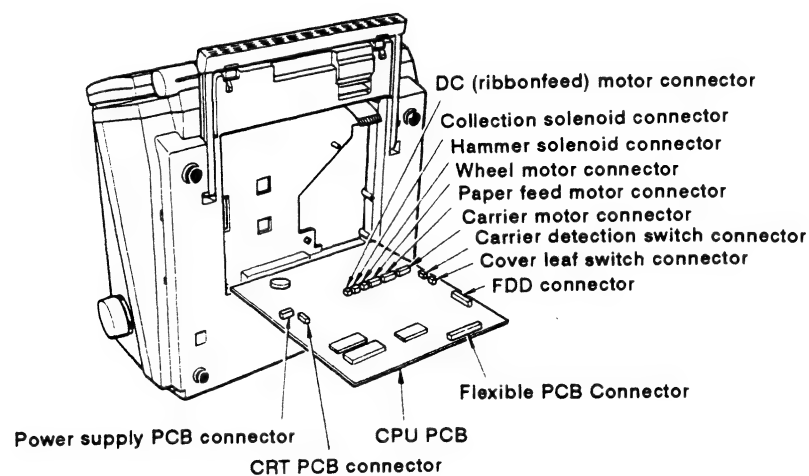


Fig. 2.2

NOTE: Be sure to release the lock mechanism of the connectors before attempting to disconnect and reconnect them.

2.2. Reassembly

To reassemble the PCB, reverse the order of disassembly.

2.3. Check and Adjustment

Make sure that the bottom plate and the CPU PCB are secured by a screw.

3. CHASSIS UNIT

3.1. Disassembly

- (1) Removal of the body cover.

See "1. COVER."

- (2) Removal of the chassis unit.

Unscrew the two screws on the center left and right of the chassis unit. At the same time, remove the collar on the right side and the toothed lock washer on the left side.

- (3) Disconnect the ground wire.

Unscrew the screw securing the power supply PCB ground wire which has been fastened to the rear left corner of the chassis.

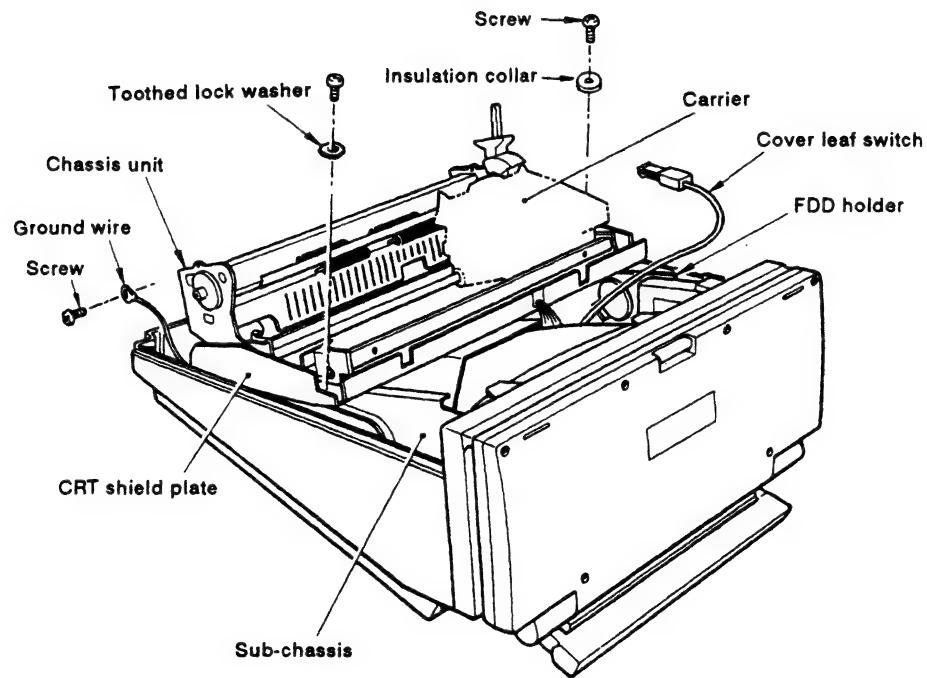


Fig. 3.1

(4) Removal of the connectors and cables.

Slide the chassis unit together with the CRT shield plate toward the front until they are separated from the chassis mount rubber. Then remove the chassis unit from the bottom cover and place the chassis unit on the rear of the bottom cover. Disconnect the following connectors from the CPU PCB. (Fig. 3.2)

- a) Carrier motor connector
- b) Paper feed motor connector
- c) Connector from the carrier unit

(5) Removal of the shield plate

- a) Unhook the cables from the paper feed motor and the carrier motor from the hooks on both sides of the CRT shield plate.
- b) Disengage the rear of the chassis unit from the CRT shield plate and move the chassis unit to the rear.

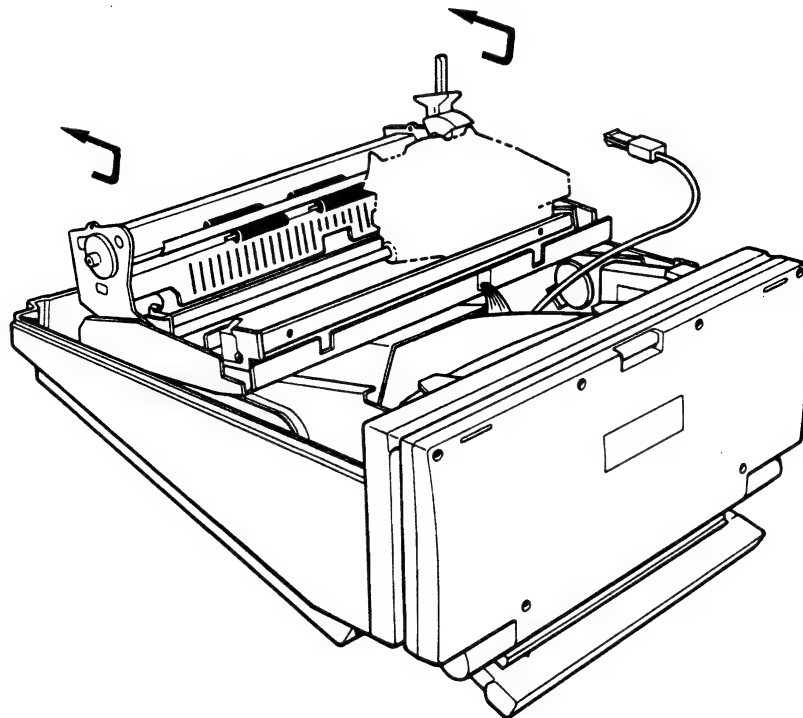


Fig. 3.2

- c) Pull the front side of the cord keeper up and unhook the two hooks securing it to the shield plate for removal. (Fig. 3.3)
- d) Push the cord keeper from both sides to unhook the hooks and push it out. (Fig. 3.3)
- e) Remove the chassis unit from the CRT shield plate.

3.2. Reassembly

- (1) To reassemble the chassis unit, reverse the order of disassembly. (See "4. SPIRAL TUBE.")
- (2) When hooking on the cord keeper, it is easier if the two rear hooks are hooked to the shield plate before pushing the cord keeper front towards the shield plate. (Fig. 3.3)

3.3. Check and Adjustment

Make sure that the chassis unit is mounted on the shield plate and the chassis mount rubber is fitted securely to the chassis.

The insulation collar which comes with the insulation paper (adhered to the bottom surface of the shield plate) is attached to keep magnetism out from the FDD unit. Otherwise the FDD unit may malfunction.

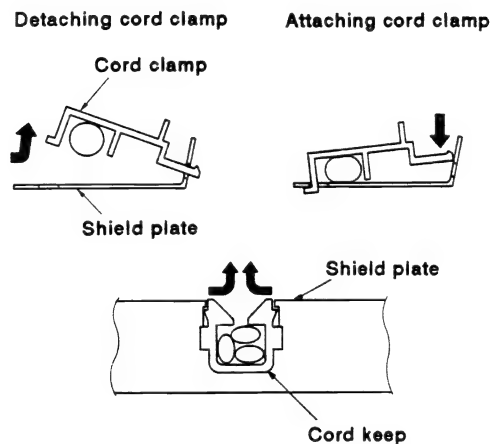


Fig. 3.3

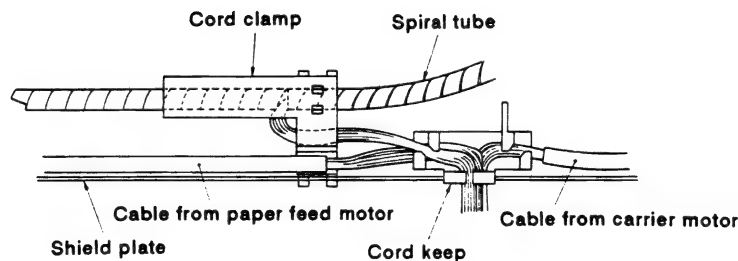


Fig. 3.4

4. SPIRAL TUBE

The wheel motor, hammer solenoid, correction solenoid, ribbon feed motor and carrier switch are mounted on the carrier frame. The lead wires to these components are gathered together and conveyed through the spiral tube to their connections.

The spiral tube should protrude from the tube holder by max. of 5 mm.

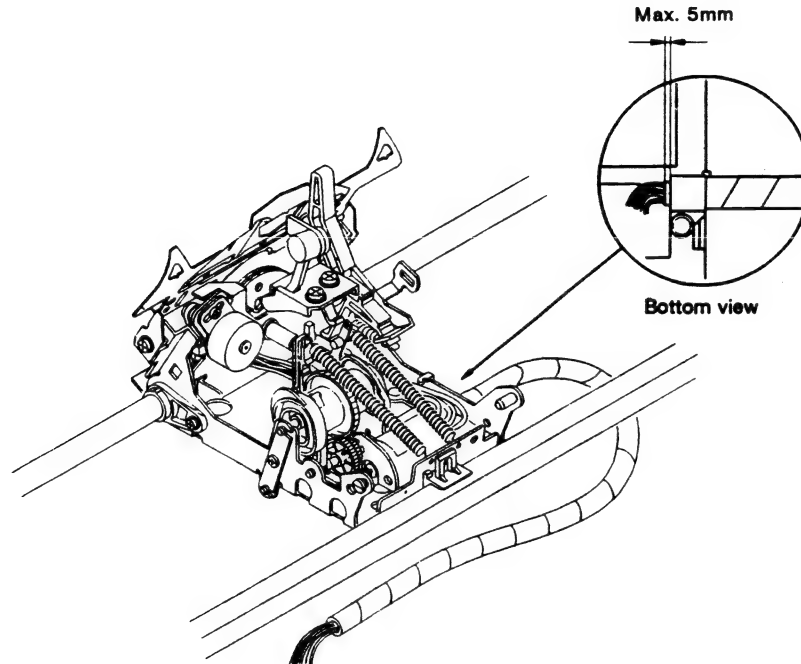


Fig. 4.1

4.1. Disassembly

- (1) Remove the chassis unit.
See "3. CHASSIS UNIT."
- (2) Remove the shield plate.
- (3) Remove the ribbon cassette support unit.
See "8. RIBBON CASSETTE SUPPORT UNIT."
- (4) Pull out the tube holder from the carrier frame and remove the lead wires from the guide.
- (5) Turn the spiral tube clockwise for removal.

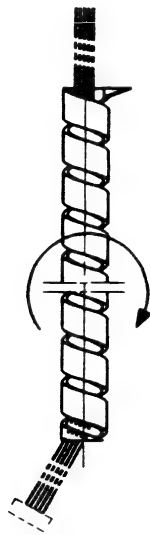
NOTE: Make sure to record the spiral tube length before removal. This will make it easier to reassemble.

4.2. Reassembly

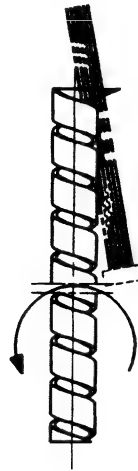
- (1) Pass each harness through the slit at one end of the spiral tube and twist it counterclockwise. With the daisy wheel cartridge set to the wheel motor support, adjust the length from the tube holder so that each harness will not be too tight or slack. Then secure the spiral tube with the tube holder to the carrier frame.
- (2) Secure the spiral tube with the cable keeper to the shield plate so that the spiral tube does not get caught between the carrier frame and the right chassis side plate when the carrier is moved all the way to the right.
- (3) After each harness has been clamped to the shield plate with the cable keepers, use the reverse order of disassembly for reassembly.

4.3. Check and Adjustment

- (1) Make sure that each of the harnesses does not interfere with the movable section or is too tight when locking and releasing the wheel motor support.



Detaching from the spiral tube



Attaching to the spiral tube

Fig. 4.2

- (2) Make sure that the carrier drive moves smoothly all the way to the right and left and the spiral tube does not get caught or stretched.

5. CARRIER DRIVE MOTOR

5.1. Disassembly

The carrier drive motor is removed after the chassis unit is removed.

- (1) The carrier drive motor is mounted on the chassis's rear. It can be removed by unscrewing the two screws securing the carrier motor.

5.2. Reassembly

With the carrier drive pulley main and the carrier drive motor pulley sub being perfectly aligned with their positioning holes, engage the carrier drive pulley gear and the carrier drive motor gear and secure the carrier drive pulley with the two screws. The two embossments on the carrier drive motor are fit into the positioning holes at the rear of the chassis.

5.3. Check and Adjustment

The carrier home position adjustment is required after the carrier drive motor is removed.
(See "7. CARRIER DRIVE UNIT.")

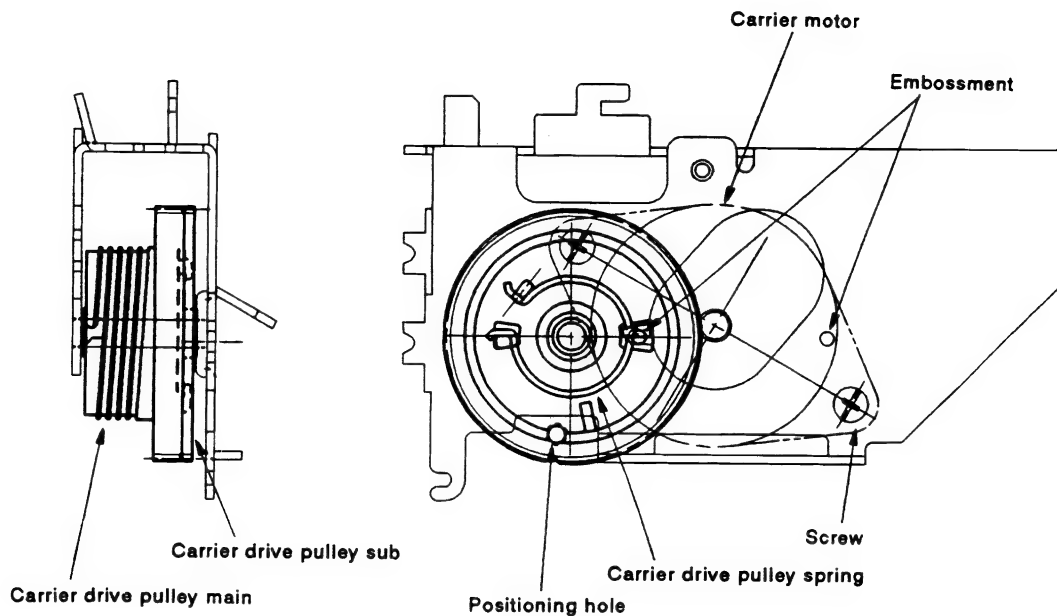


Fig. 5.1

6. DRIVE WIRE AND DRIVE PULLEY

6.1. Disassembly

Remove the carrier drive motor before removing the drive wire and the drive pulley.

- (1) Remove the drive wire clamp to remove the carrier from the drive wire.
- (2) Loosen the two nuts securing the tension pulley support to the left chassis side plate to remove the tension pulley.
- (3) Unwind the drive wire from the carrier drive pulley assembly.
- (4) Pull out the carrier drive pulley shaft from the rear chassis to remove the carrier drive pulley.

6.2. Reassembly

- (1) Fit the carrier drive pulley assembly onto the chassis.
- (2) Fit the tension pulley onto the tension pulley support.
- (3) Hook one end of the drive wire in the slot in the carrier drive pulley assembly. This holds one end of the drive wire in place by a wire clip.
- (4) Wind the other end of the drive wire around the tension pulley. Rotate the carrier drive pulley assembly to wind on the drive wire.
- (5) Hook the other (free) end in its slot on the carrier drive pulley assembly gear section. At this time, both ends of the drive wire are secured to the carrier drive pulley assembly by their wire clips.
- (6) Tighten the nuts holding the tension pulley support to the left chassis side plate. Adjust the tension of the drive wire. Attach the drive wire to the carrier frame using the drive wire clamp. Adjust the carrier home position with the checker. (See "7. CARRIER DRIVE UNIT")

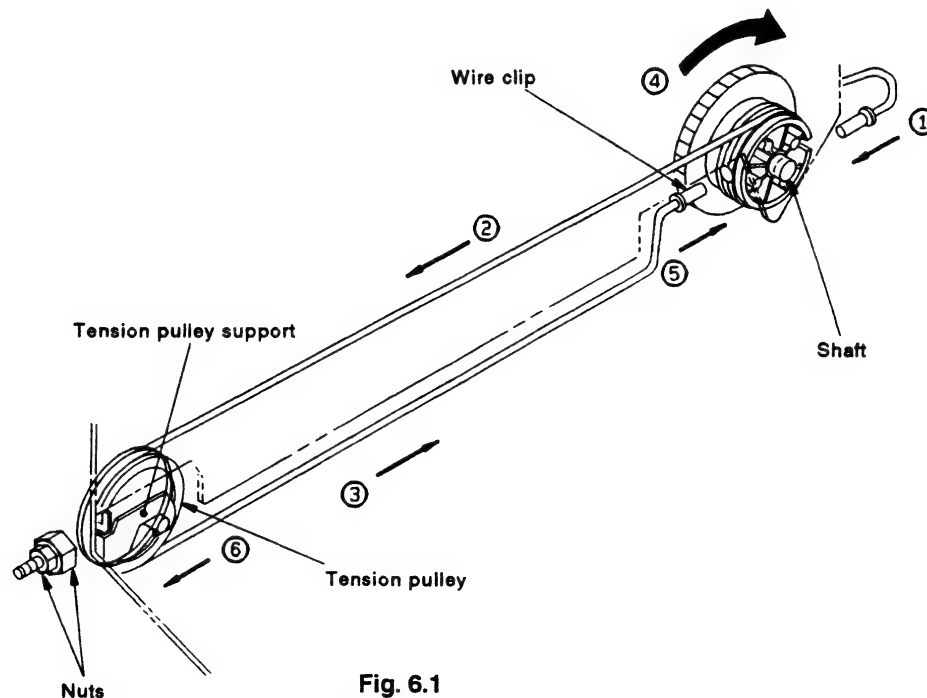


Fig. 6.1

6.3. Check and Adjustment

6.3.1. Adjustment of the drive wire tension

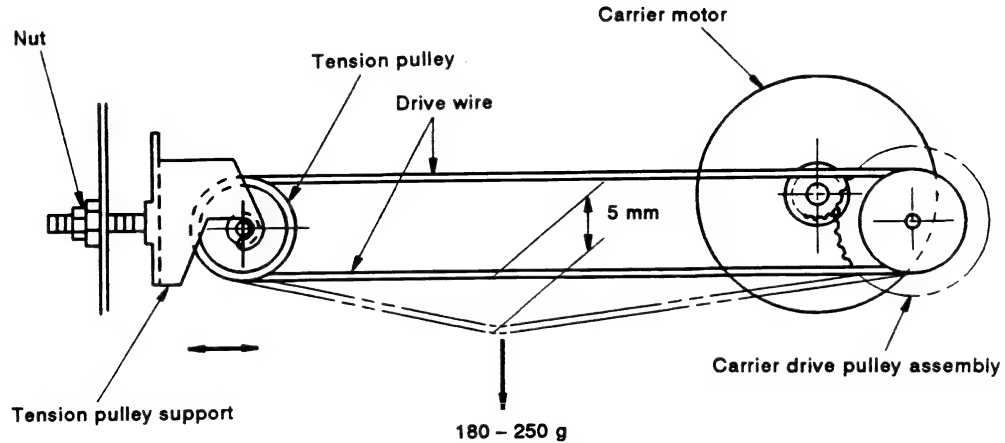


Fig. 6.2

- (1) Make sure that the wire clips are correctly attached to the carrier drive pulley assembly and that the drive wire is wound around the grooves of the drive pulley drum.
- (2) Pull the drive wire, fully unwinding the wire from the drive pulley, then wind it back. Repeat this two or three times to make sure the wire is pliable enough to smoothly wind around the pulley. (The rope tension at this time is 300 to 400 g/5 mm.)
- (3) Rotate the carrier drive pulley until the upper drive wire comes off from the middle of the drum groove. (Fig. 6.3)
- (4) Check and adjust the drive wire tension between the carrier drive pulley and the tension pulley using the following procedure:
 - a) The lower drive wire should be depressed 5 mm when a load of 180 - 250 grams is applied to its center. If it is not, make the following adjustments:
 - b) To increase the tension, first loosen the outer nut holding the tension pulley support. Then, tighten the inner nut to adjust the wire tension. After adjustment, tighten the outer nut to secure the tension pulley support.

Note: Each time the wire tension is changed, repeat the procedure in item (2) to make sure the wire is pliable before measuring the tension.

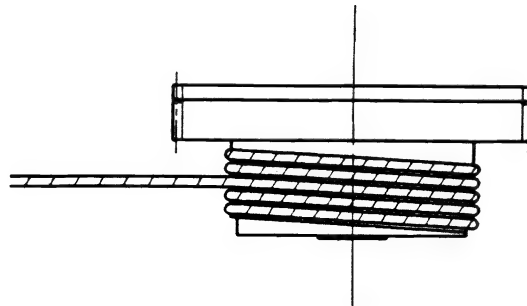


Fig. 6.3

7. CARRIER DRIVE UNIT

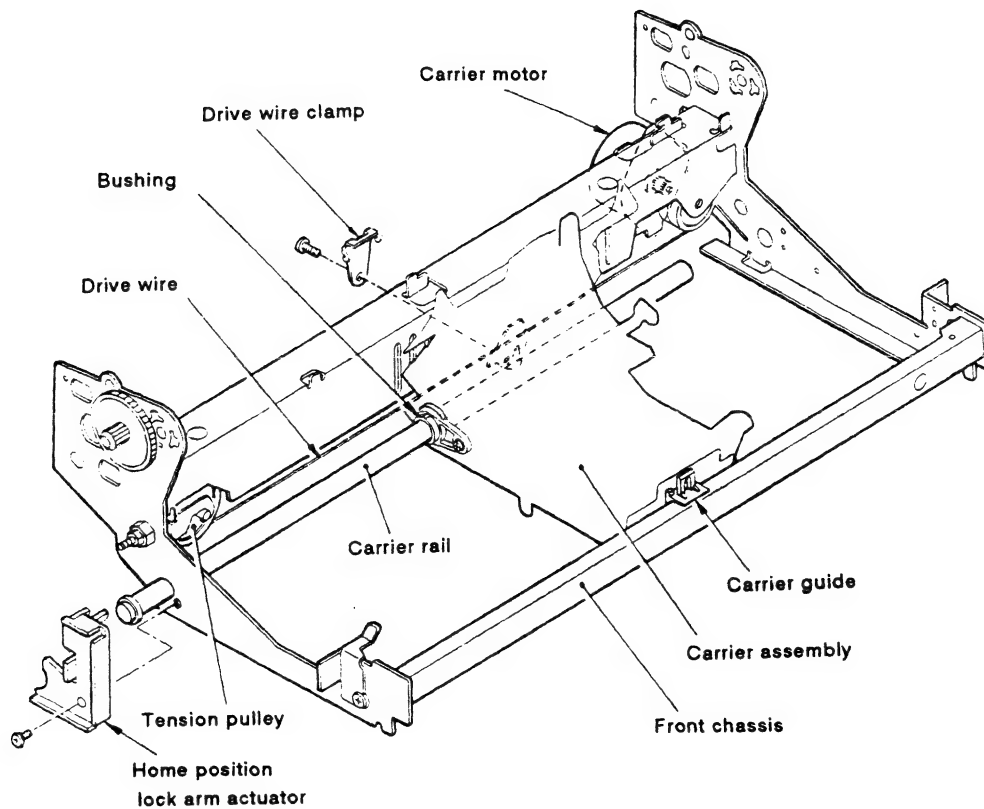


Fig. 7.1

7.1. Disassembly

- (1) Remove the chassis unit and the platen.
See "3. CHASSIS UNIT."
- (2) Unscrew the drive wire clamp and remove.
- (3) Unscrew the home position lock arm actuator and remove the carrier rail.
- (4) Remove the carrier guide from the front chassis then remove the carrier drive unit.

7.2. Reassembly

To reassemble the carrier, reverse the order of disassembly.

7.3.1. Fixing the drive wire

- ### 7.3.2. Adjustment of the carrier home position and correction pop-up

-
- Diagram illustrating the Daisy Wheel Home Positioning Method. The sequence of positions (0 to 42) is shown, with the carrier home position (left end) and the daisy wheel home position (16) marked. The allowable adjustment range is defined by the leftmost and rightmost limits, with the adjustment point at the daisy wheel home position.

- 42 -

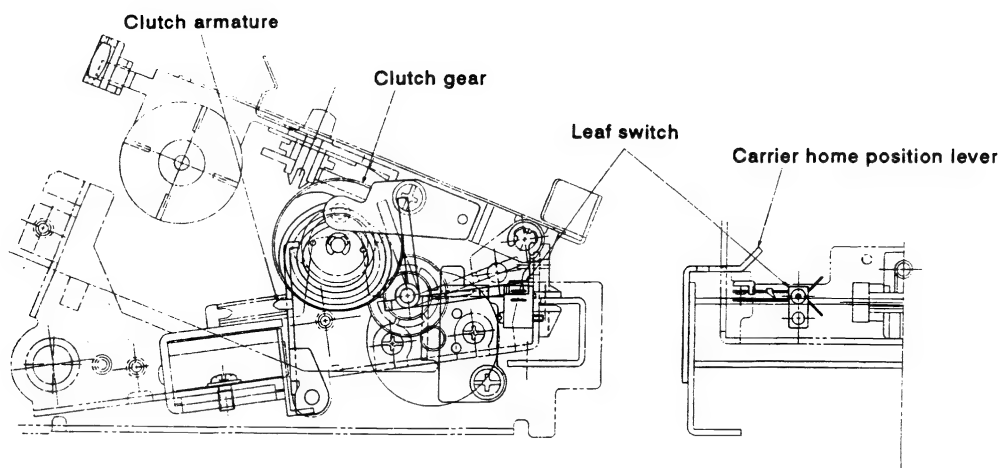


Fig. 7.3

7.3.3. Adjustment of the daisy wheel home position lock arm

- (1) Move the carrier to the right two steps from the left limit of travel. Rotate the daisy wheel gear in the direction shown by the arrow in Fig. 7.3. Make sure that the daisy wheel home position lock arm securely locks the home position lock ratchet on the daisy wheel gear (if not, adjust it by bending part (B) of the home position lock arm actuator).
- (2) For adjusting of the wheel motor, see "10.3.1 Adjustment of the wheel motor home position." (Fig. 10.2)

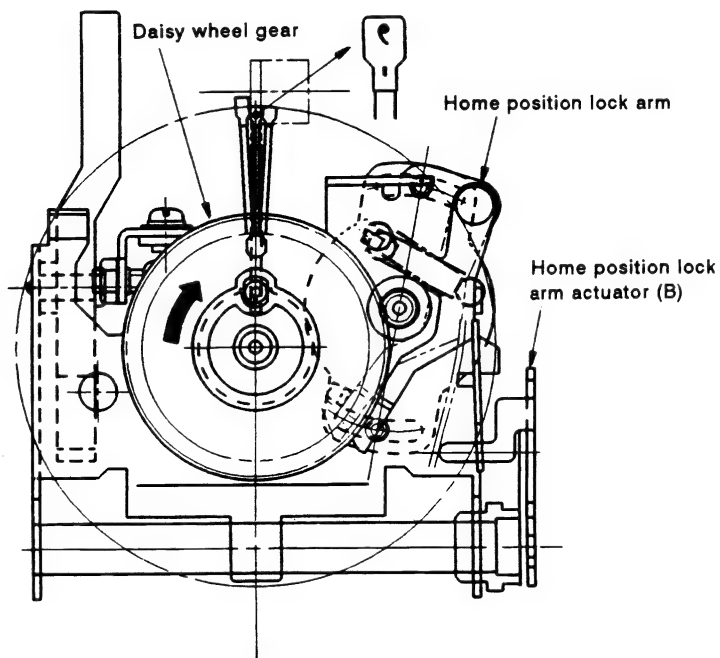


Fig. 7.4

8. RIBBON CASSETTE SUPPORT ASSEMBLY

8.1. Disassembly

- (1) Remove the snap ring.
- (2) Move the ribbon cassette support assembly a little to the left to pull it out from the front of the carrier frame. Then lift the ribbon cassette support assembly up to remove.

8.2. Reassembly

Insert the shaft of the correction cam follower into the groove on the correction cam and the shaft of the correction tape feed link into its hole in the carrier frame.

Fit the holes on both sides of the ribbon cassette support front to the mounting pins on both sides of the carrier frame. Fit the snap ring.

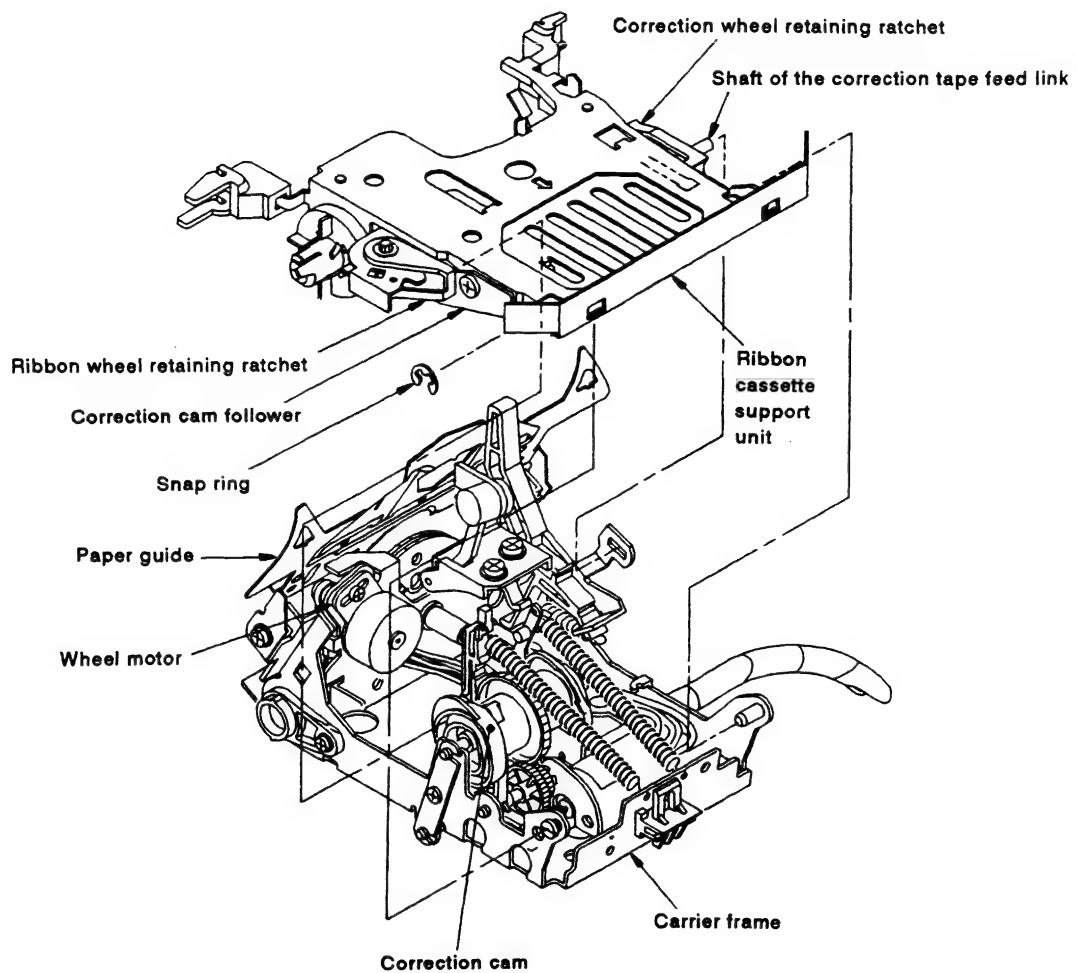


Fig. 8.1

If the correction wheel retaining ratchet is removed from the ribbon cassette support assembly, check and adjustment of its mounting position is necessary.

8.3. Check and Adjustment

8.3.1. Ribbon feed ratchet wheel

Make sure that there is a gap at (B) between the ribbon feed ratchet and the ribbon feed ratchet wheel when there is no gap at (A) between the ribbon feed ratchet wheel and the ribbon feed retaining ratchet.

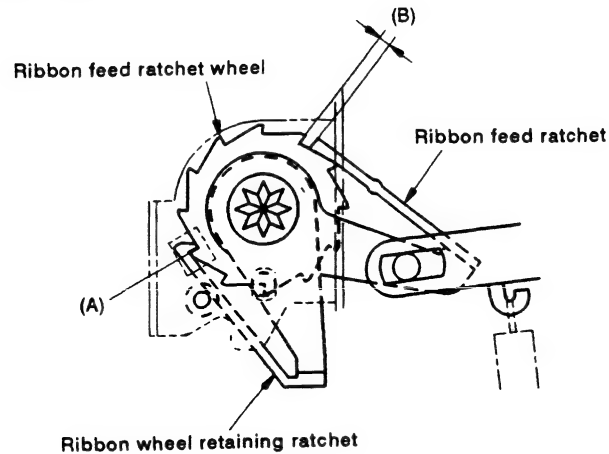


Fig. 8.2

8.3.2. Correction wheel retaining ratchet

When reassembling the correction wheel retaining ratchet, the screw used to hold it to the cassette support needs to be positioned correctly in its slot hole. Loosen the screw and move the correction wheel retaining ratchet backward or forward to adjust clearance (A) to 0.9 to 2.0 mm when the cassette support assembly is assembled to the carrier frame.

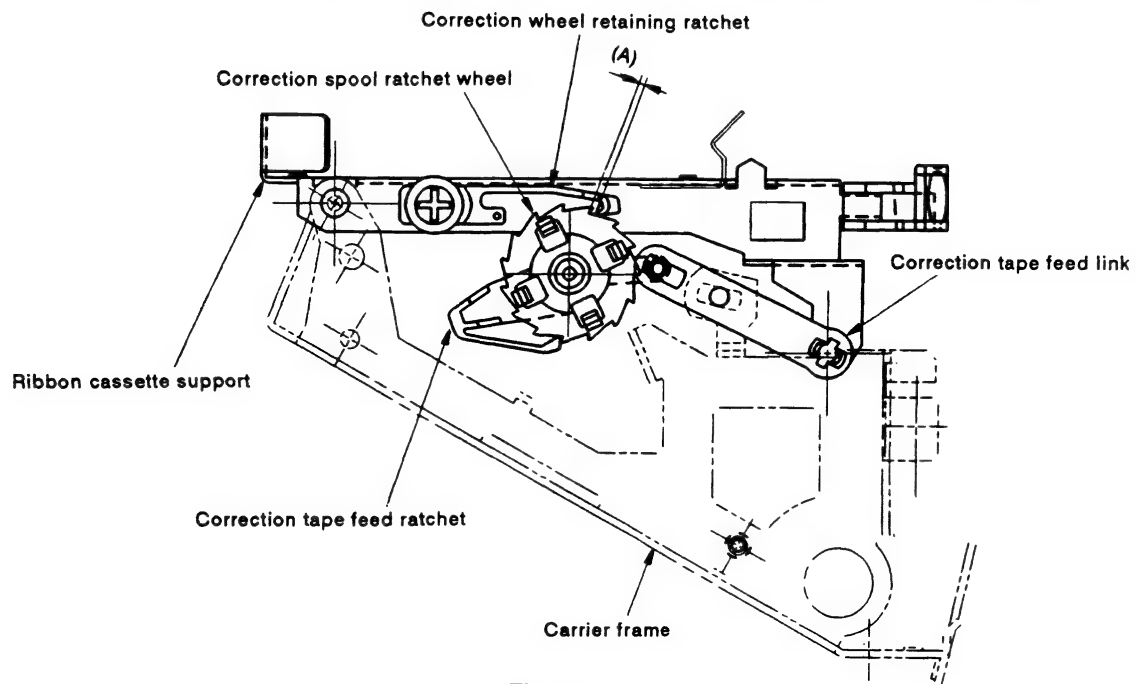


Fig. 8.3

9. HAMMER SUPPORT UNIT

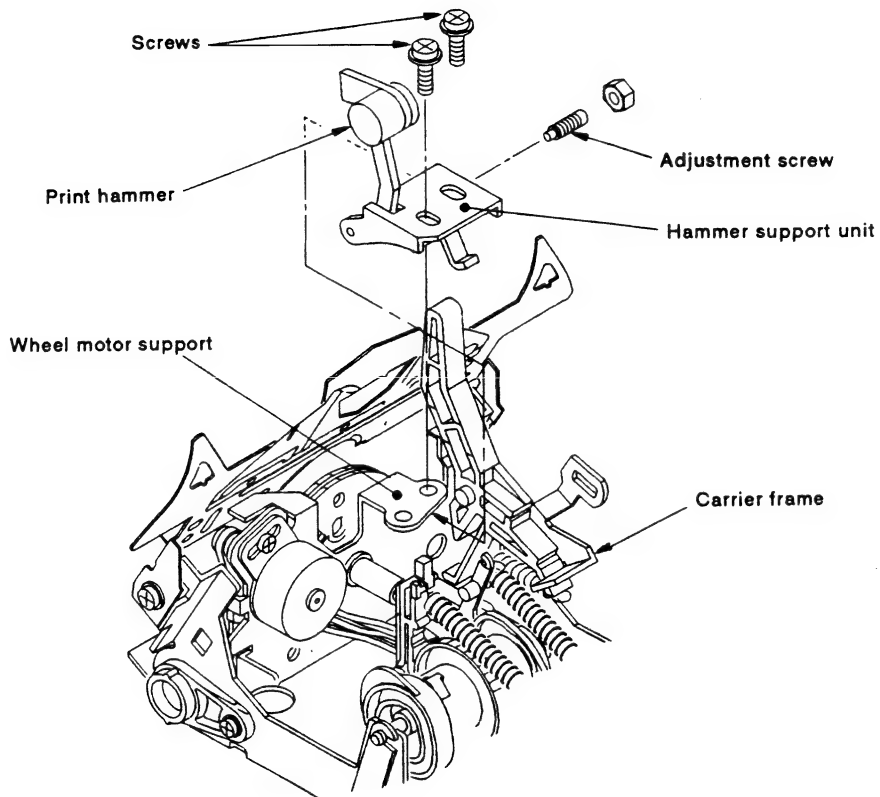


Fig. 9.1

9.1. Disassembly

- (1) Remove the ribbon cassette support assembly.
- (2) Unscrew the two screws holding the hammer support unit on top and lift the hammer support unit towards the front to remove it from the wheel motor support.
- (3) Unscrew the screw attaching the print hammer to the hammer support to remove.

9.2. Reassembly

To reassemble the hammer support unit, reverse the order of disassembly.

There must be no lateral play of the print hammer and the print hammer should operate by its empty weight.

9.3. Check and Adjustment

9.3.1. Adjustment of the hammer support assembly

When reassembling the hammer support assembly, adjust its lateral position so that the center of the print hammer is aligned with the center of the slot in the daisy wheel gear when the daisy wheel gear is at its home position or the center of the print hammer is aligned with the center of the detent of the spoke for comma "," when the daisy wheel is fitted.

If the detent of the spoke and the center of the print hammer do not align, the print characters will blur. Together with the adjustment of printing position in lateral direction, the print position should also be adjusted.

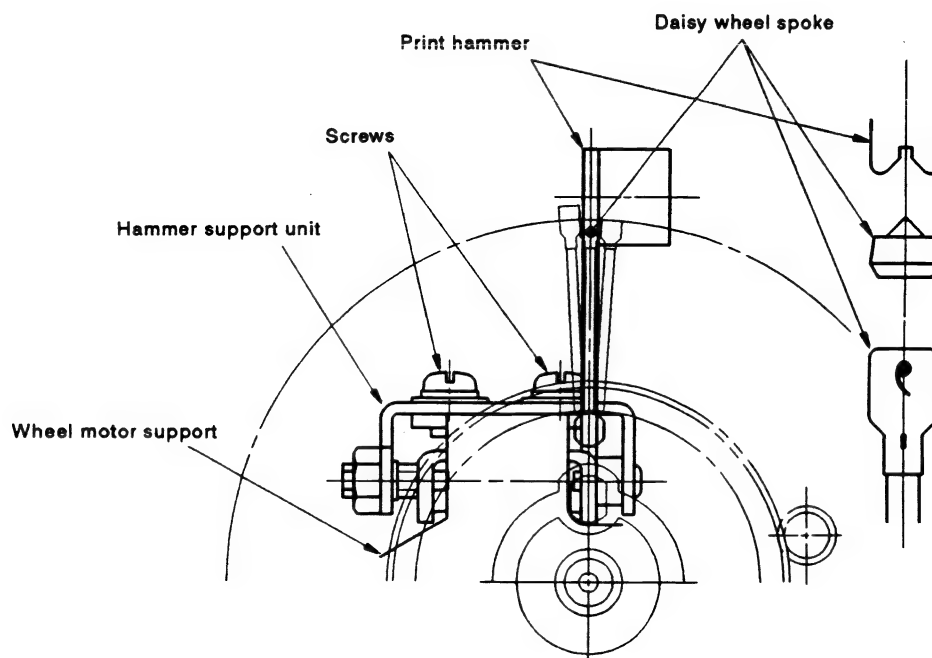


Fig. 9.2

9.3.2. Adjustment of the printing position

Move the hammer by hand to strike the spoke for "H" against the platen. Make sure that the spoke and the platen are flush with each other.

Fit the ribbon cassette support assembly and a fabric ribbon cassette. Print "H" repeatedly. Check if the printed thickness of the characters vary between top and bottom, or if they are slanted. To correct uneven print thickness, adjust the radial alignment, as follows:

Loosen the screws on the top that secure the hammer support unit. Moving the hammer support unit closer to the platen results in thicker printing at the bottom. Moving it toward the keyboard results in thicker printing at the top.

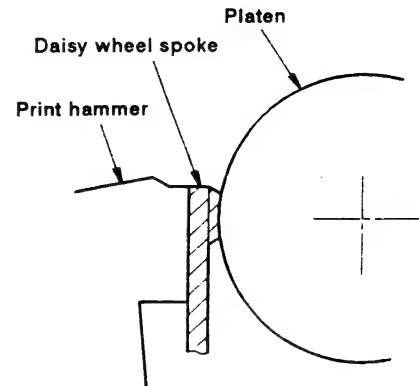
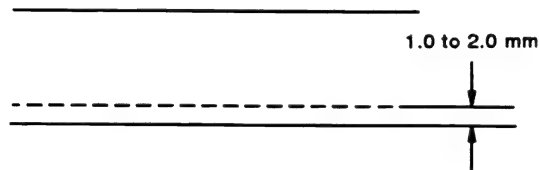


Fig. 9.3

Print underlines "_" with a carbon ribbon.

Check if the underlines are printed 1.0 mm to 2.0 mm above the lower edge of the ribbon. If not, adjust by loosening the screws securing the cam follower unit and moving it up or down (See Fig. 8.1). Repeat this check with a correction tape.



Note: If the print thickness varies even after adjusting the position of the hammer support unit, it is because the gap between the platen and the daisy wheel spoke for "H" is outside the range of 4.0 to 5.0 mm.

In this case, correct the gap by bending part (C) of the wheel motor support to adjust its longitudinal position (See Fig. 9.4). Then recheck the printing.

After the printing position has been adjusted, check and adjust the gap between the daisy wheel spoke and the platen at printing.

9.3.3. Adjustment of the gap between the daisy wheel spoke and the platen

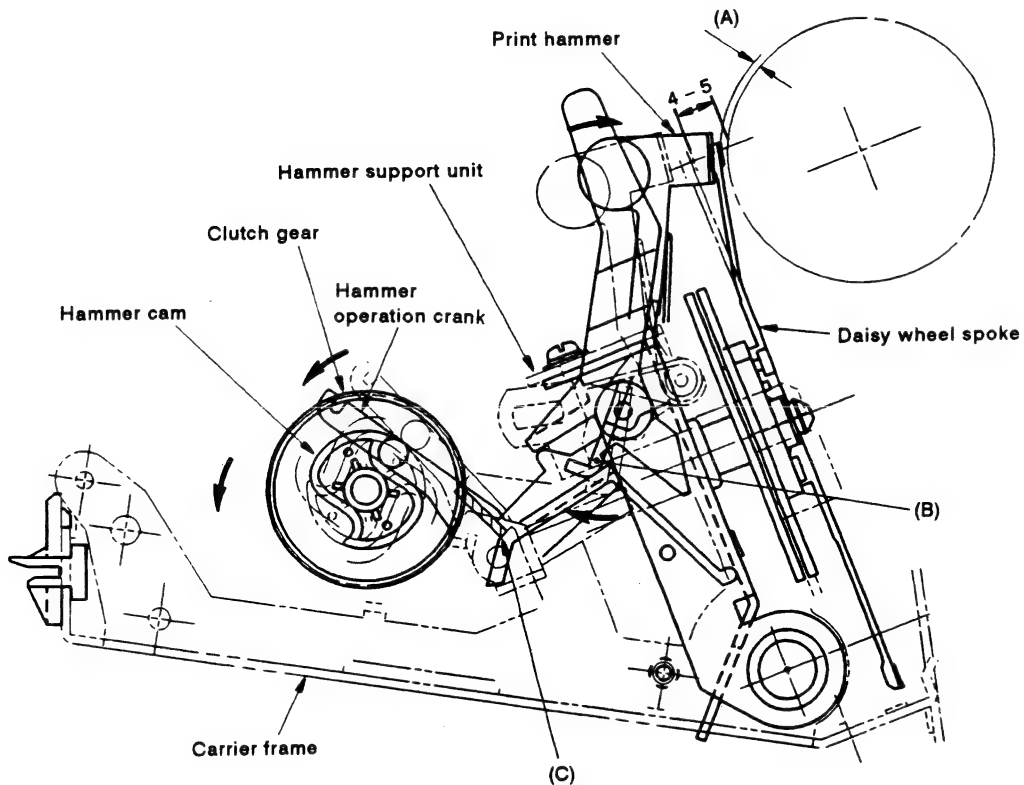


Fig. 9.4

Adjust the gap between the daisy wheel spoke and the platen by the following procedure:

Release the clutch armature from the hammer clutch collar. Rotate the clutch gear counterclockwise by hand to rotate the hammer cam. When the shaft of the hammer operation crank drops off the lobe on the hammer drive cam, the hammer operation crank is pulled toward the word processor front, causing the hammer to strike the selected spoke. Adjust the gap (A) between the spoke and the platen after the hammer strikes to between 0.4 to 0.8 mm by bending part (B) of the hammer.

10. WHEEL MOTOR

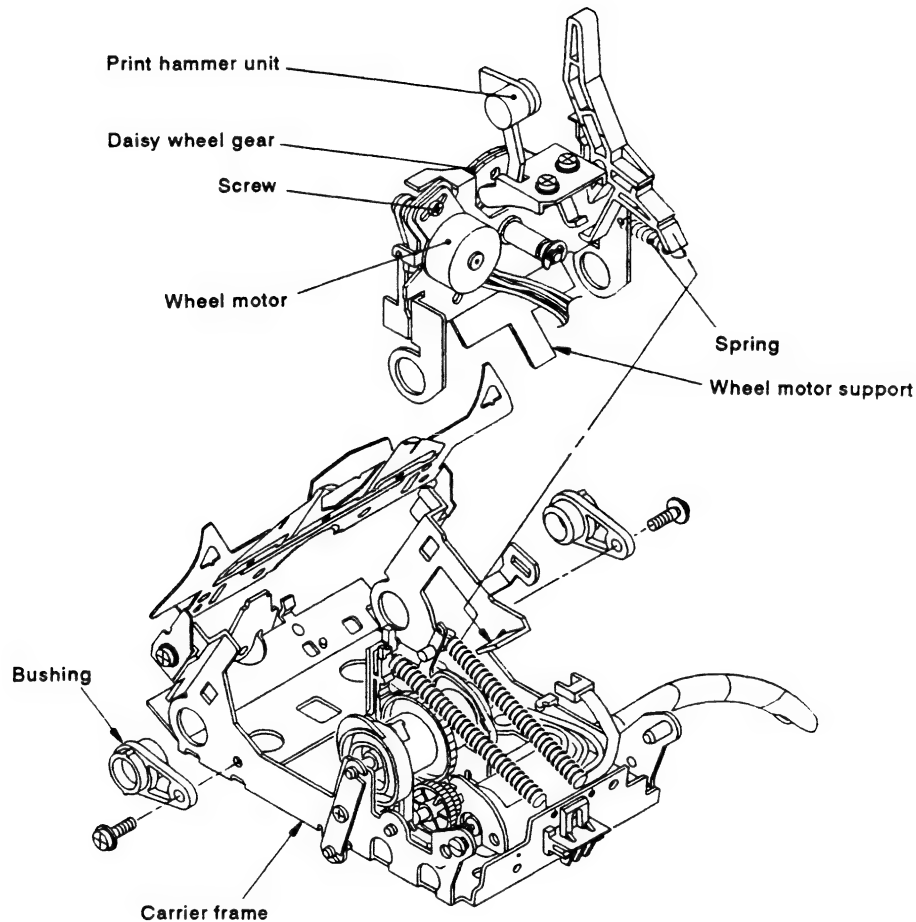


Fig. 10.1

10.1. Disassembly

- (1) Remove the carrier drive unit.
See "7. CARRIER DRIVE UNIT"
- (2) Remove the ribbon cassette support assembly.
- (3) Unhook the coil spring from carrier frame.
- (4) Remove the left and right bushing from the carrier frame.
- (5) Lift up the wheel motor support to remove the wheel motor together with the hammer mechanism and the daisy wheel gear.

Note: Before disengaging the wheel motor and the daisy wheel gear, mark the wheel motor gear and the daisy wheel gear where their teeth mesh. This is necessary to correctly reengage these gears since they are designed so that the home positions of the wheel motor and the daisy wheel gear match each other. When replacing the wheel motor or daisy wheel gear, adjust the wheel motor home position using the checker.

10.2. Reassembly

To reassemble the wheel motor, reverse the order of disassembly.

10.3. Check and Adjustment

10.3.1. Wheel motor home position

- (1) Remove the snap ring and the daisy wheel gear from wheel motor support.
- (2) Attach the wheel motor to the wheel motor support, leave its screws "finger tight."
- (3) Connect the power supply PCB and the wheel motor connector to the checker and excite the home position of the motor in the C-D phase.
- (4) Fit the daisy wheel gear to the wheel motor support with the center of its slot aligned with the gear top center. Engage the daisy wheel gear with the wheel motor gear in its home position.
- (5) Fit the daisy wheel cartridge. Loosen the two screws holding the wheel motor. Rotate it until the center of the hammer is aligned with the detent of the spoke for comma ",", then tighten the wheel motor screws.

Note: Make sure that the hammer and the hammer support unit are correctly fitted to the wheel motor support before adjusting the wheel motor home position.

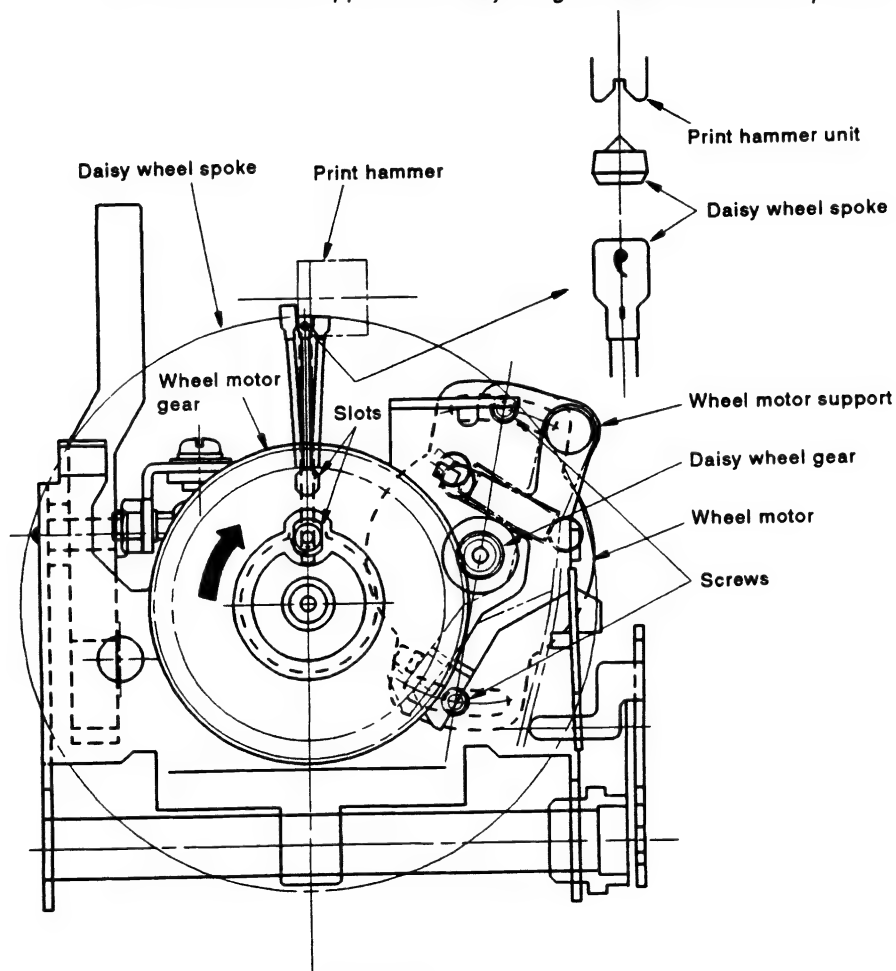


Fig. 10.2

11. PAPER GUIDE

The paper guide unit is attached to the carrier frame with the ribbon guide fitted to it.

11.1. Disassembly

Unscrew the two screws attaching the paper guide to the carrier frame to remove.

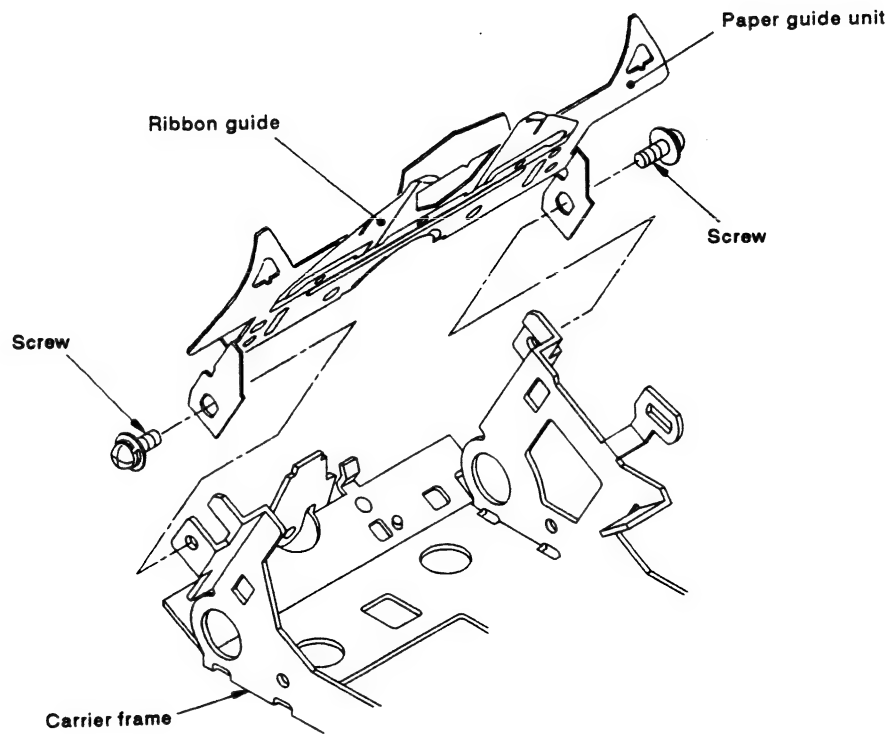


Fig. 11.1

11.2. Reassembly

To reassemble the paper guide, reverse the order of disassembly.

11.3. Check and Adjustment

11.3.1. Paper guide position

Adjust the gap (A) between the ribbon guide and the paper guide to 0.4 mm or more, and the gap (B) between the paper guide and the platen to 0.1 to 0.4 mm. Adjust gap (B) by unscrewing the screws attaching the paper guide and reposition the paper guide and gap (A) by bending the release lever (C) on the carrier frame and changing the motor holder angle.

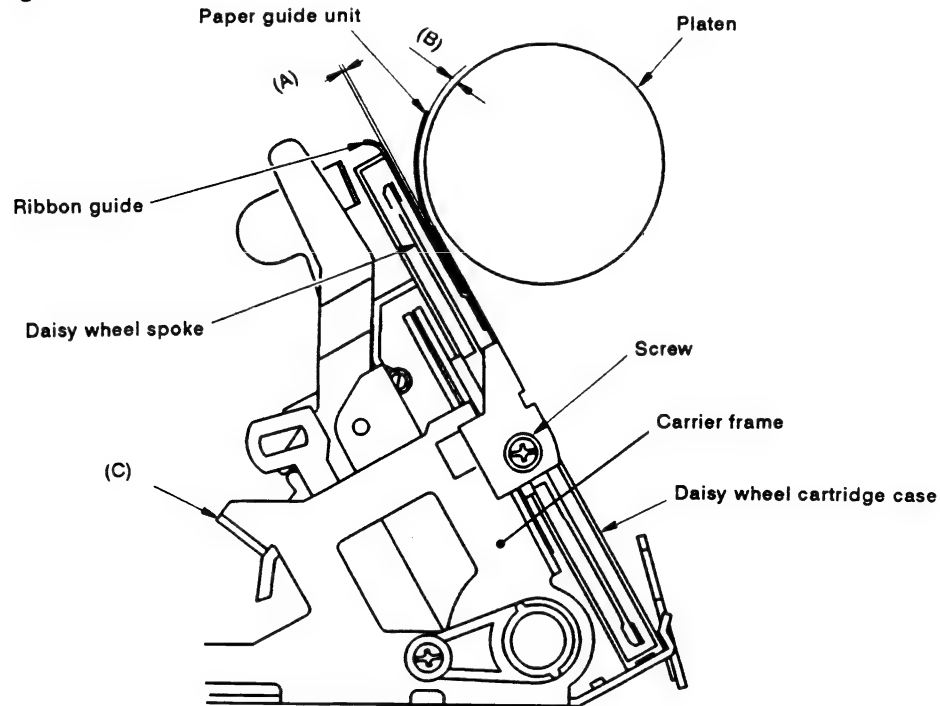


Fig. 11.2

The vertical position of the paper guide is adjusted by repeatedly printing "I" and checking that the position of the upper horizontal edge of the paper guide, in reference to the printed characters, is within the tolerance specified in the figure below. If not, loosen the screws and adjust the paper guide position.

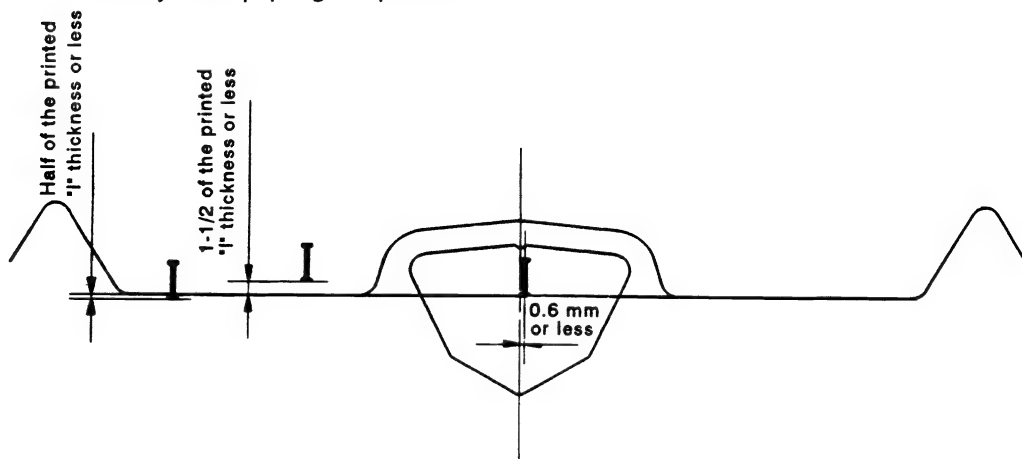


Fig. 11.3

12. CLUTCH ASSEMBLY

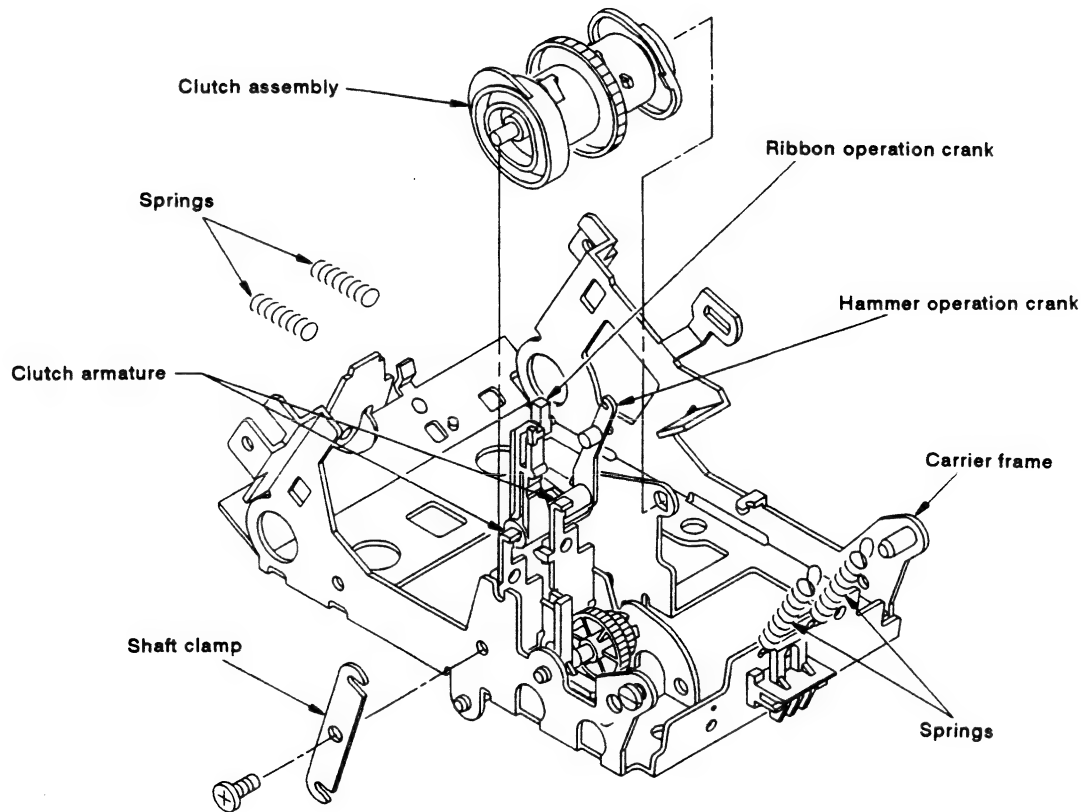


Fig. 12.1

12.1. Disassembly

- (1) Remove the ribbon cassette support assembly.
- (2) Unhook the coil springs from the hammer operation crank and the ribbon operation crank.
- (3) Unscrew the shaft clamp.
- (4) Unhook the coil springs from the clutch armatures.
- (5) Pull out the clutch assembly shaft from the carrier frame with the clutch assembly parts still attached, and lift it up to remove.

Remove the snap ring from the shaft to disassemble the clutch assembly, (these include the correction cam, correction clutch collar, correction clutch spring, clutch gear, hammer clutch collar, hammer clutch spring, hammer cam, and the plain washer).

Reassembly of these parts requires correct positioning. (Fig. 12.2)

12.2. Reassembly

To reassemble the clutch assembly, reverse the order of disassembly.

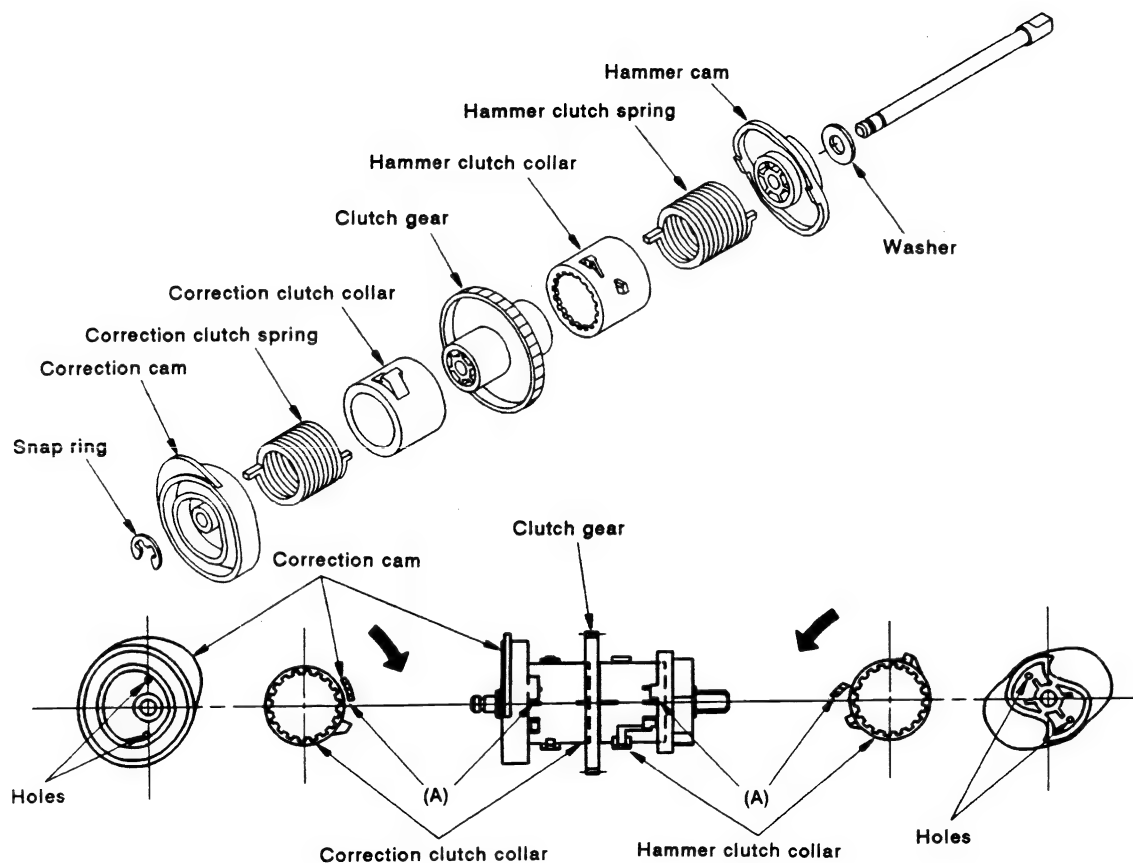


Fig. 12.2

12.3. Check and Adjustment

12.3.1. Correction clutch

Fit the correction clutch spring so that part (A) of the correction cam comes between the two small grooves of the correction clutch collar. The two grooves correctly locate its position when the clutch gear is rotated in the direction indicated by the arrow, with the correction clutch collar held still. This is done by correctly positioning the holes of the correction cam. See Fig. 12.2

12.3.2. Hammer clutch collar

Fit the hammer clutch spring so that part (A) of the hammer cam comes between the two small grooves of the hammer clutch collar. The two grooves correctly locate its position when the clutch gear is located in the direction indicated by the arrow, with the hammer clutch collar held still. This is done by correctly positioning the holes of the hammer cam.

12.3.3. Adjustment of the position of hammer solenoid and correction solenoid

When the clutch armature is pushed against the hammer solenoid and the correction solenoid, the hooks of the clutch armature and the clutch collar will release. Check that the gap (B) on both the hammer solenoid side and the correction solenoid side is 0.6 to 1.2 mm, and that the gap (D) is 0.1 to 0.3 mm. Make sure that there is no gap between the clutch armature and the solenoid, and the gap (C) is 0.7 to 0.9 mm.

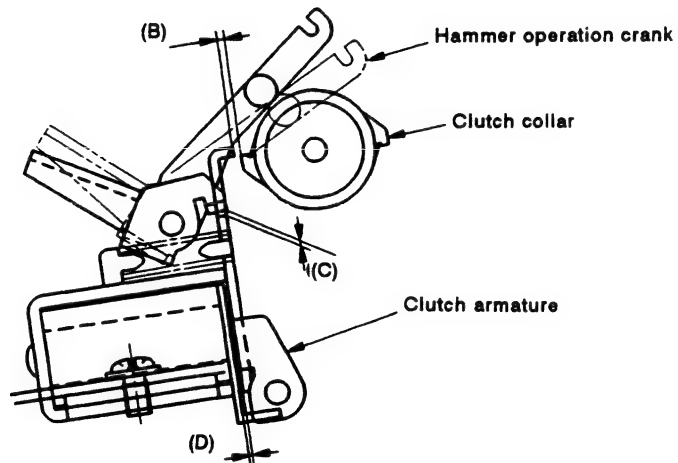


Fig. 12.3

13. PAPER FEED MOTOR

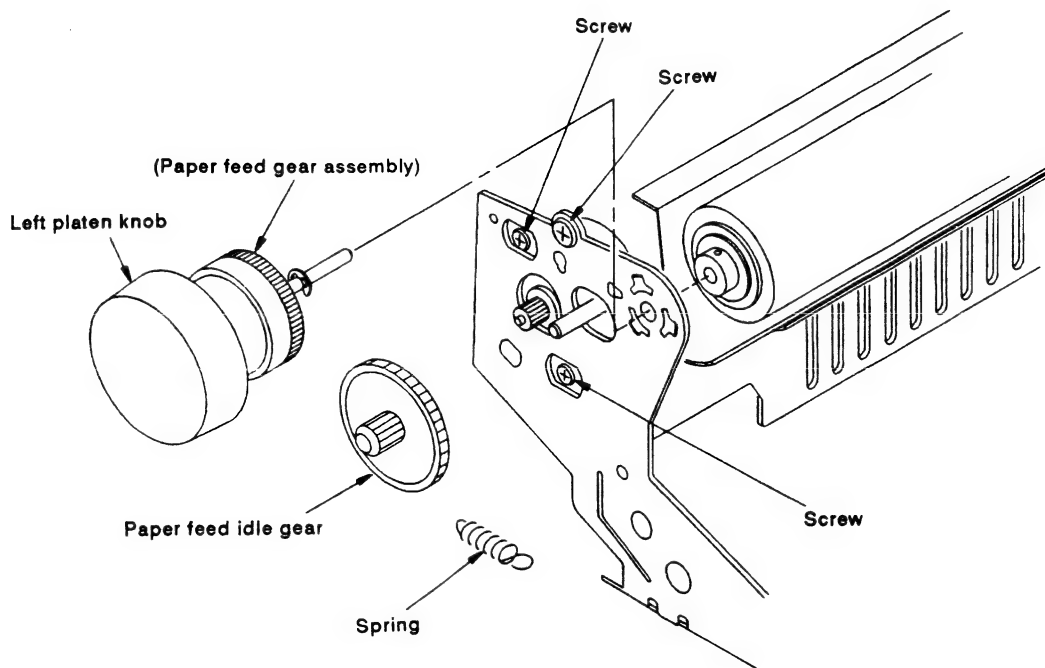


Fig. 13.1

13.1. Disassembly

- (1) Remove the body cover.
See "1. COVER."
- (2) Pull the paper feed idle gear out.
- (3) Unhook the coil spring.
- (4) Unscrew the two stepped screws attaching the paper feed motor holder to the left classes side plate.
- (5) Unscrew the two screws attaching the paper feed motor.

Note: To detach only the paper feed motor, unscrew only the two screws attaching the paper feed motor.

13.2. Reassembly

To reassemble the paper feed motor, reverse the order of disassembly.

14. FRONT PANEL

14.1. Disassembly

- (1) Remove the body cover.

See "1. COVER."

- (2) Remove the chassis unit.

See "3 CHASSIS UNIT."

Caution!

The CRT and CRT PCB include high voltage parts, so there is a danger of electric shock when handling them. Even after the power is turned off, there is still some danger of electric shock.

For this reason, do not touch the fly-back transformer or the CRT anode (anode cap), or any of the cable terminals connected to them, or the deflection yoke cable terminals, with bare hands.

If touching these parts is absolutely unavoidable, first discharge the anode using a multimeter.

- a) Insert the banana plug of the probe between the grounding mesh braid and the carbon-covered insulation of the CRT.
- b) Do not by any means connect the anode to the PCB support or the ground plate on the PCB. If these parts are touched by mistake, it could damage the IC chips mounted on the CRT PCB.
- c) To prevent the banana plug from coming off, tape it on temporarily with vinyl electrical insulating tape.

Putting the pin under the anode cap as shown in Fig. 14.1 will cause the voltage to be discharged suddenly before actual contact is made. The probe should be held under and against the anode cap for at least 5 seconds or more to discharge the anode completely.

When handling the CRT, take particular care not to damage it. The CRT neck especially should not be subjected to any load.

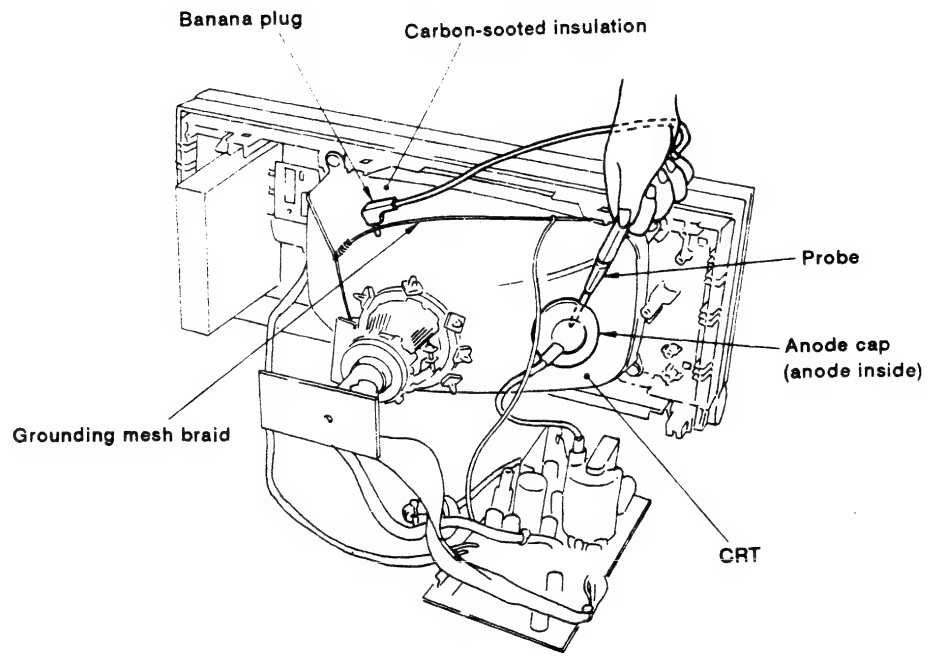
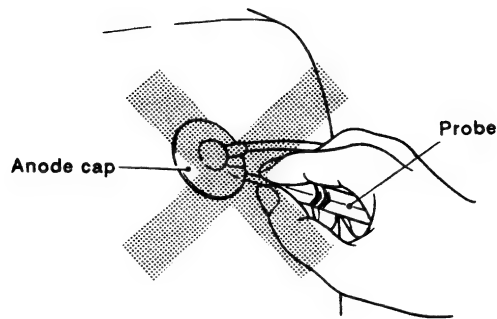
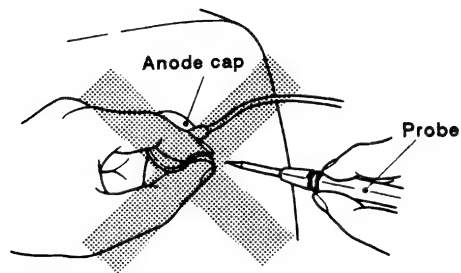


Fig. 14.1



- Never touch the metal portion of the probe.



- Never turn over the anode cap with your fingers even if (tab) it is hard to insert the probe pin.

Fig. 14.2

(3) Remove the CRT shield plate.

The CRT shield plate is hooked by two catches to the ground plate on both side, respectively. First, release the catches on the right side and then the catches on the left side. Then, remove the CRT shield plate.

(4) Remove the sub-chassis and FDD holder

Unscrew all four screws securing the sub-chassis (two screws) and the FDD holder (two screws).

(5) Disconnect the connectors.

Unhook the cables from the hook on the bottom cover and disconnect the following cables.

- a) Disconnect the connector to the CRT PCB from the power supply PCB.
- b) Disconnect the connector to the CPU PCB from the CRT PCB.
- c) Disconnect the connector to the CPU PCB from the FDD unit.
- d) Disconnect the brightness control cable connector from the hook on the bottom cover.

(6) Remove the front panel.

- a) Disconnect the four hooks securing the CRT PCB to the bottom cover and remove the CRT PCB.
- b) Lift the front panel and tilt it to the front, with the keyboard panel being closed.
- c) Remove the FPC PCB from the CPU PCB.

Note: Since the CRT PCB is removed at the same time, be careful not to break any wires that might be caught, and do not subject the CRT neck to any loads.

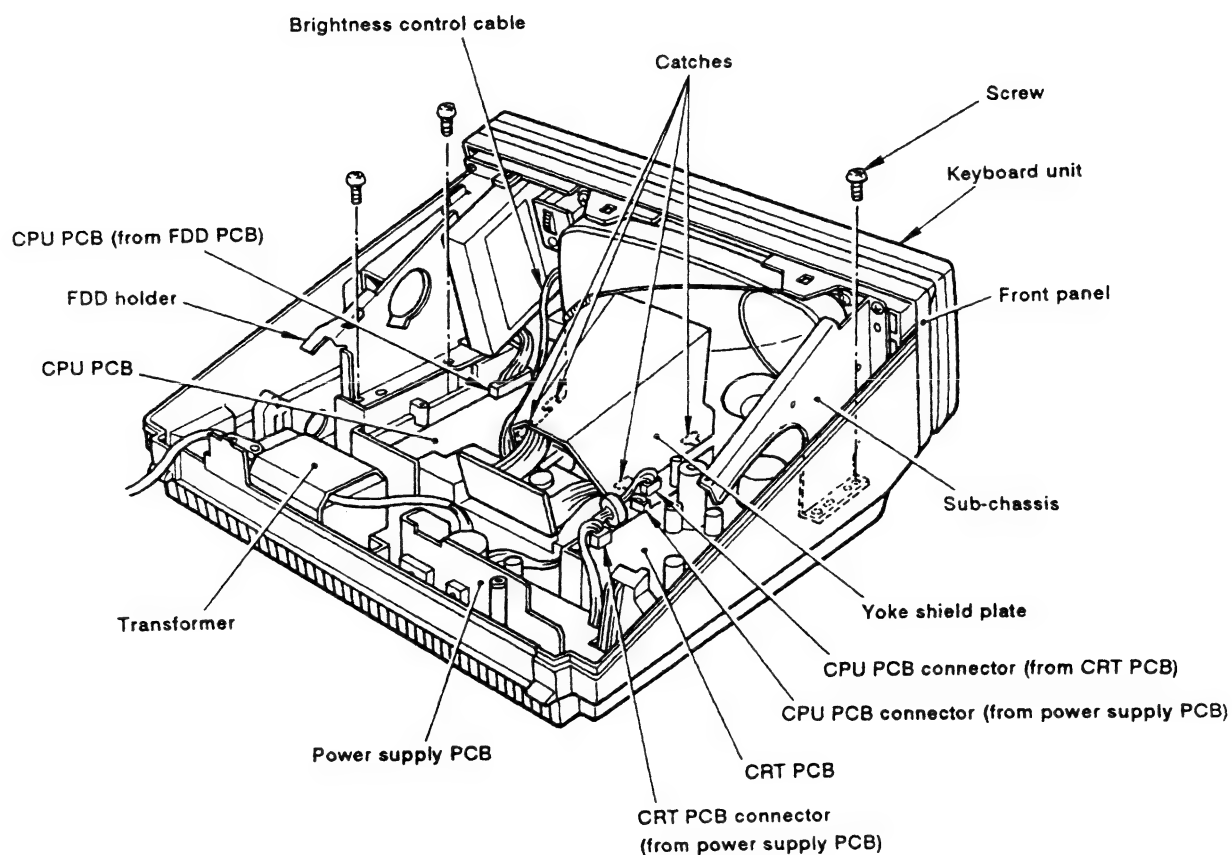


Fig. 14.3

14.2. Reassembly

To reassembly the front panel, reverse the order of disassembly.

Note: When connecting the FPC PCB to the CPU PCB, the indentations on the FPC PCB are positioned at the window of the bottom cover. (Fig. 14.5)

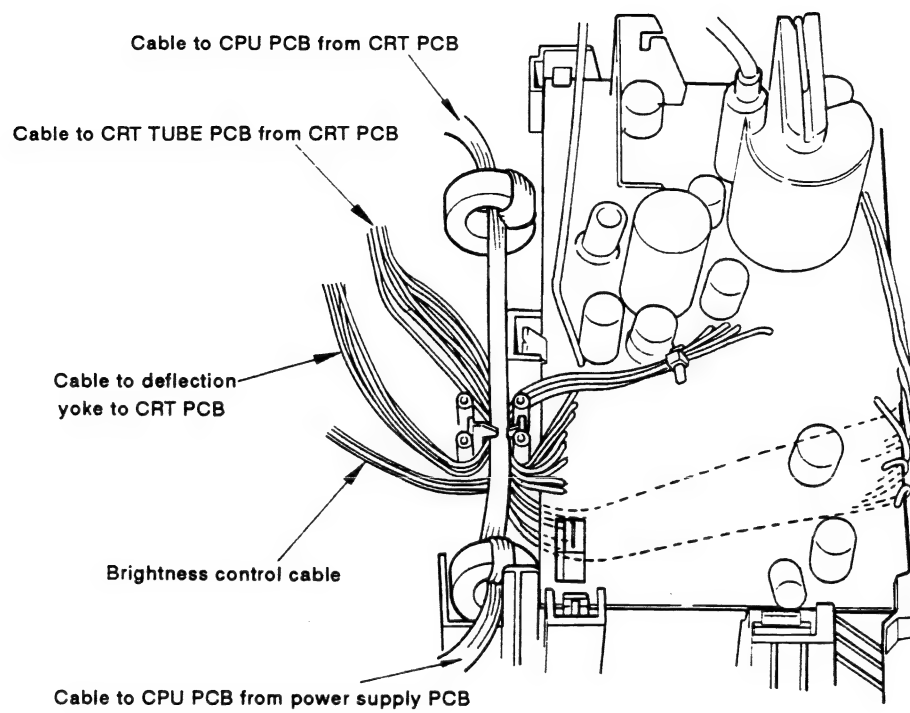


Fig. 14.4

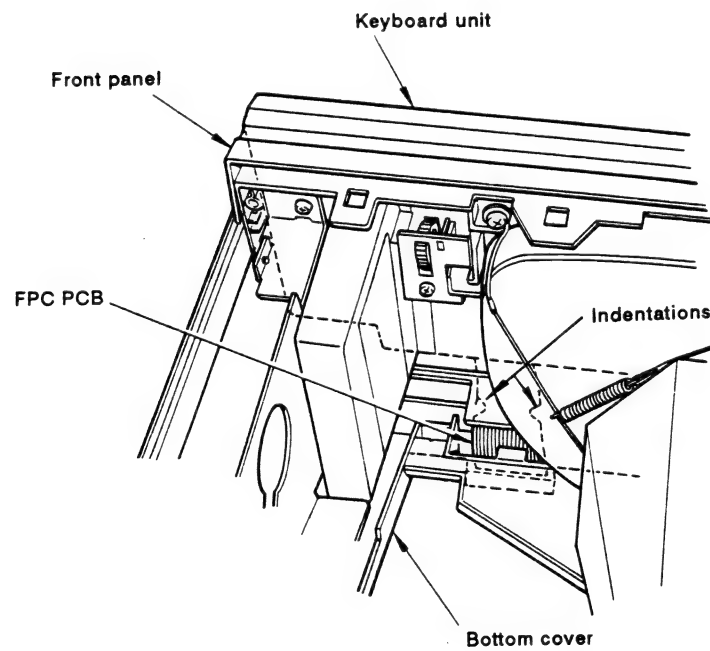


Fig. 14.5

14.3. Check and Adjustment

(1) Front panel

Make sure that the front panel is securely engaged to the bottom cover with the catches and that the front panel is pushed against the bottom cover front.

(2) CRT PCB

Make sure that the CRT PCB is secured to the bottom cover by the hooks and that there is no looseness or floating.

(3) Connectors, harnesses

Make sure that each connector is securely connected and that the brightness control cable is clamped in the hook in the bottom cover and on the clamp on the ground plate.

(4) CRT shield plate and the ground plate

Make sure that the CRT shield plate is hooked securely in four places and that there is no looseness.

15. SUB-CHASSIS AND FDD HOLDER

15.1. Disassembly

- (1) Removal of the front panel.

See "14. FRONT PANEL."

- (2) Removal of the sub-chassis side plates and the FDD holder.

Unscrew the four screws securing the sub-chassis side plates and the FDD holder to the front panel for removal.

- (3) Removal of the FDD unit.

See "19. FLOPPY DISK DRIVE (FDD) UNIT."

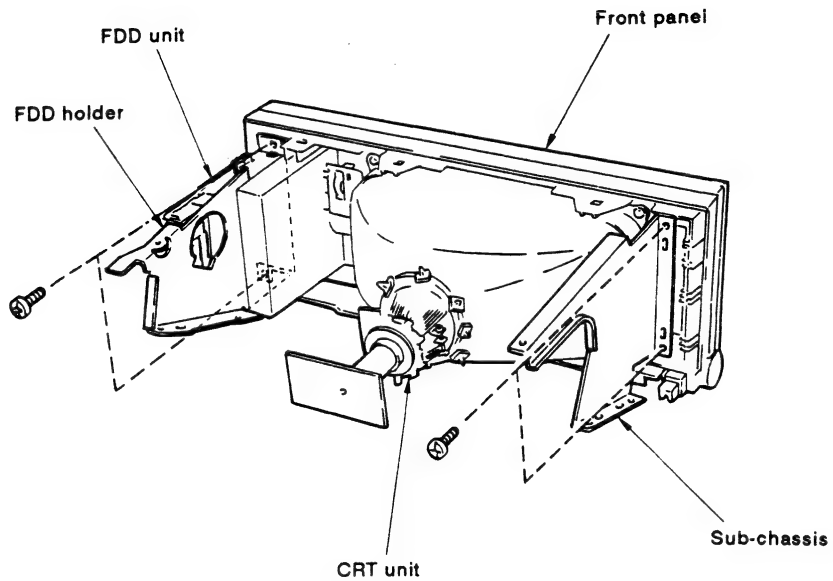


Fig. 15.1

15.2. Reassembly

To reassemble the sub-chassis and the FDD holder, reverse the order of disassembly.

16. CRT DISPLAY AND CRT PCB

16.1. Disassembly

- (1) Removal of the front panel.
See "14. FRONT PANEL."
- (2) Removal of the sub-chassis and the FDD holder.
See "15. SUB-CHASSIS AND FDD HOLDER."
- (3) Removal of the brightness adjustment knob.
 - a) Unhook and remove the volume holder from the front panel.
 - b) Remove the volume.
- (4) Removal of the CRT and the CRT PCB.
 - a) Unscrew the four screws and toothed lock washers secure the CRT to the front panel for removal.

Note: *The CRT and the CRT PCB are connected together and cannot be separated. Be careful not to snag the CRT PCB harness on other parts or bump other parts when removing the CRT.*

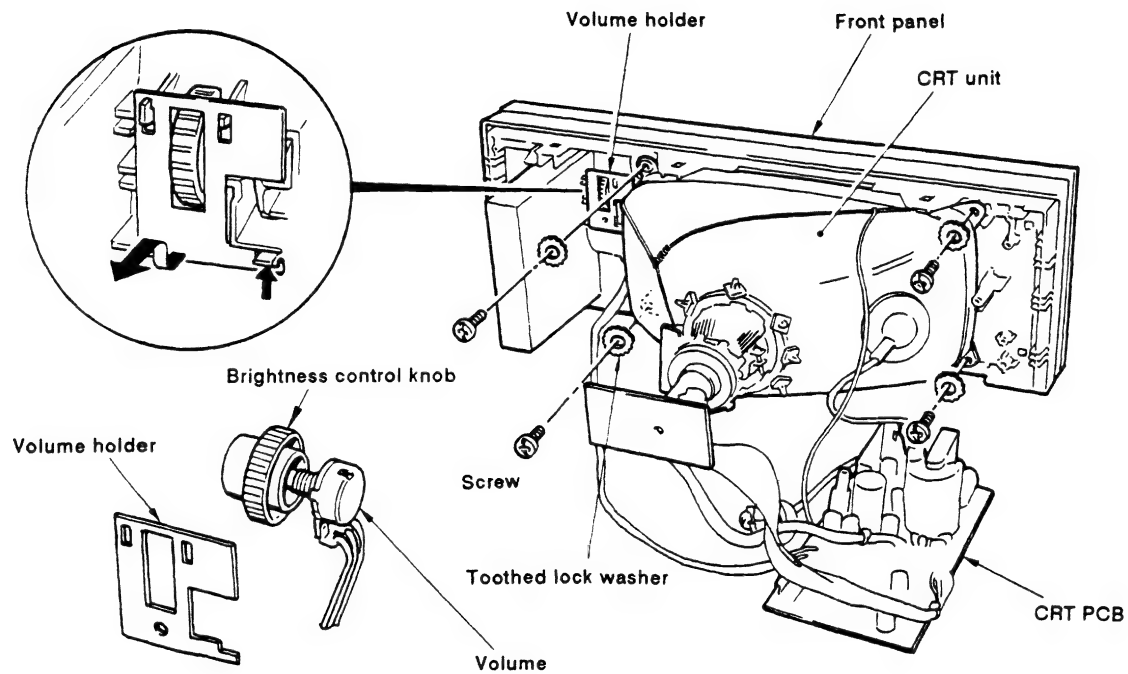


Fig. 16.1

- b) Remove the CRT TUBE PCB from the rear of the CRT.

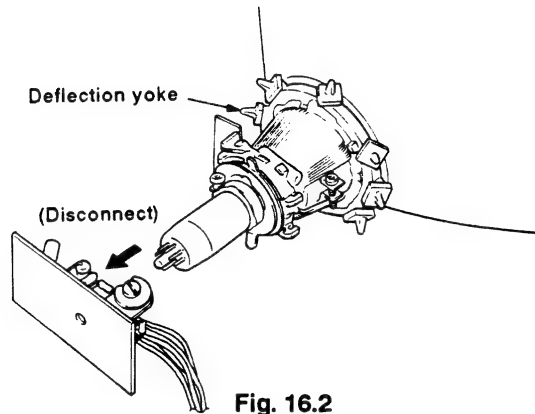


Fig. 16.2

- c) Make sure that before disconnecting the anode cap, any electricity of the high electric load which remains inside the cap is discharged to GND. Use a multi-meter cord.

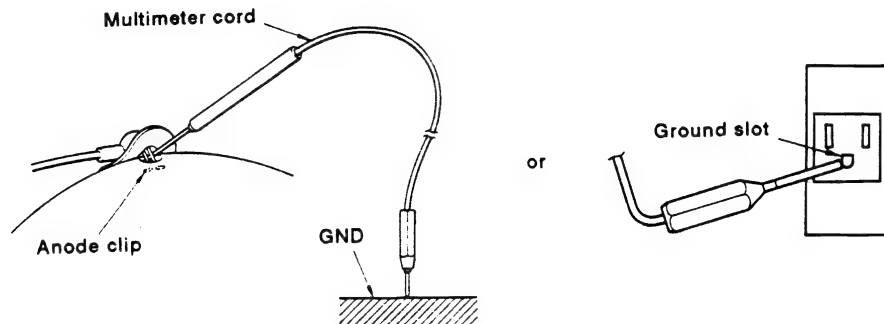


Fig. 16.3

Note: Even though the electricity changed in the anode clip discharges with a crack when a tester rod is touched, it will not discharge completely. Keep the tester rod touching the clip for approx. 5 sec. to discharge the electricity completely.

- d) Turn over the anode cap and disconnect the anode clip from the CRT with needle nose pliers.

Note: Do not touch the anode even after removal of the anode clip from the CRT.

- e) Remove the knit wire from the ears on the CRT.

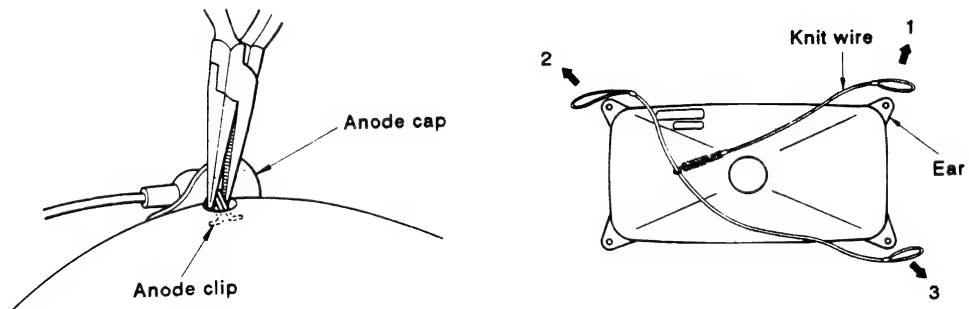


Fig. 16.4

- (5) Remove the deflection yoke
- a) Loosen the deflection yoke mounting screws.

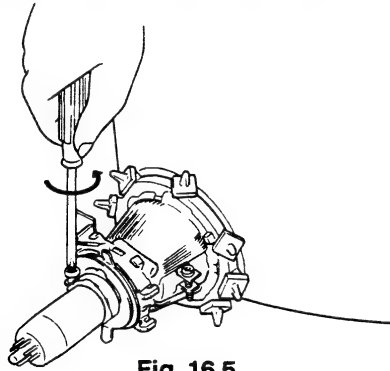


Fig. 16.5

- b) Pull the deflection yoke off in the direction of the CRT cathode.

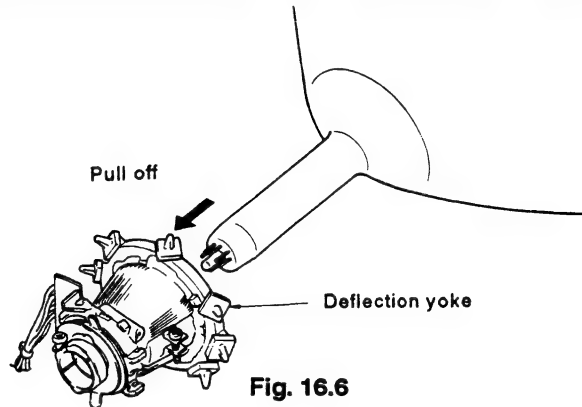


Fig. 16.6

16.2. Reassembly

To reassemble the CRT and CRT PCB, reverse the order of disassembly, but exercise caution in the following:

- (1) After connecting the deflection yoke on the CRT, push it hard toward the front of the CRT while fastening the screw. (Tighten the screw with a torque of 4 kg/f.)
- (2) Since many wire harnesses run from the CRT PCB, be careful not to tangle them.
- (3) Make sure the wire harness comes out downward from the anode cap.
- (4) Make sure to fit the projections on inner circumference of the knob with the notch on the volume control shaft when pushing the knob onto the volume.

16.3. Check and Adjustment

16.3.1. Fitting the CRT in the front panel

- (1) Fit the CRT in the front panel so that the anode is on the left.
- (2) Place the CRT in the center of the CRT blinder so that the width of the black escutcheons around the CRT screen is equal on all four sides, including the corners, when viewed from the front panel side.

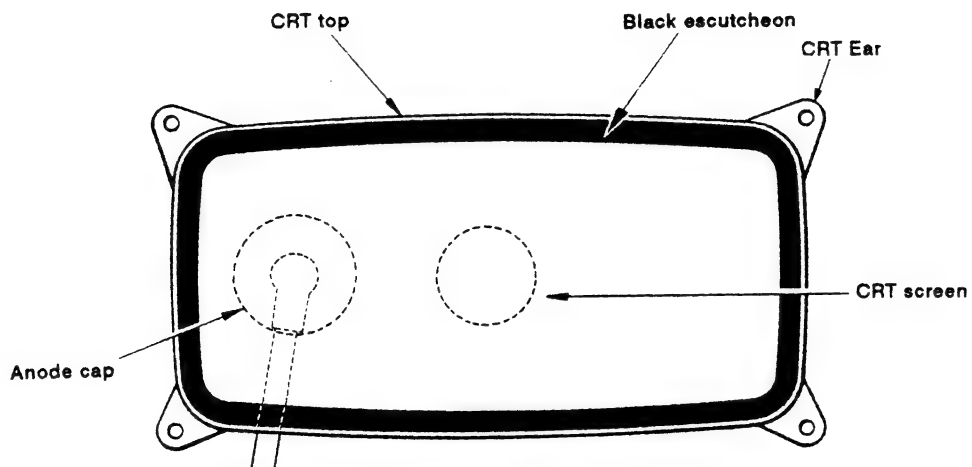


Fig. 16.7

16.3.2. Tools for adjustment of CRT display

(1) Self-test

Press CODE + SHIFT + BS keys in the normal typewriter mode to start the self test program built in the machine.

<Menu screen>

***** SELF TEST MENU *****	
CRT	1, 2, 3, 4
PRINTER	5
KEYBOARD	6, 7, 8
DETENT	9
CR/LF	A
Please select the number. Press TW/WP to finish.	

Press the key 1 through 4 key. Various inspection patterns can be displayed on the screen.

- To return to the menu screen during the self-test, press any keys.
- To finish the self-test, press TW/WP key. Then the main program will start.
- To correct the test number in the menu screen, press CORRECT key.
- In the self test mode, the numeric keys and all junction keys are only enabled. Entry of other keys will cause error.

(2) Alignment screwdriver for CRT PCB

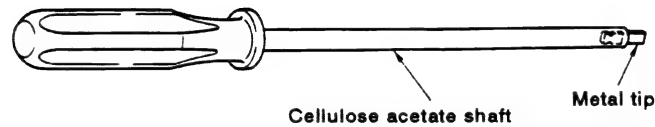


Fig. 16.8

Unlike the CPU PCB and motor drive circuit, some parts of the CRT PCB use extremely high voltages (up to 12kV). Exercise extreme caution during every adjustment operation.

For adjustment of parts with high voltages, use an alignment screwdriver like that shown above to prevent electric shocks.



Fig. 16.9

If an alignment screwdriver is not available, a thin common screwdriver can be used by insulating the shaft with heat shrink tubing, leaving only the tip exposed. Make sure that the tube does not slide loosely on the shaft after heating.

Do not use a magnetized screwdriver.

16.3.3. Adjustment of CRT

(1) Positions to be adjusted

The CRT screen can be adjusted by changing the fitting condition of the CRT, centering magnet, deflection yoke magnet and the volume on the CRT PCB. As the first step, try to adjust the display by changing the fitting condition of the CRT or by turning the centering magnet. If that adjustment is not effective, move on to the next adjustment step.

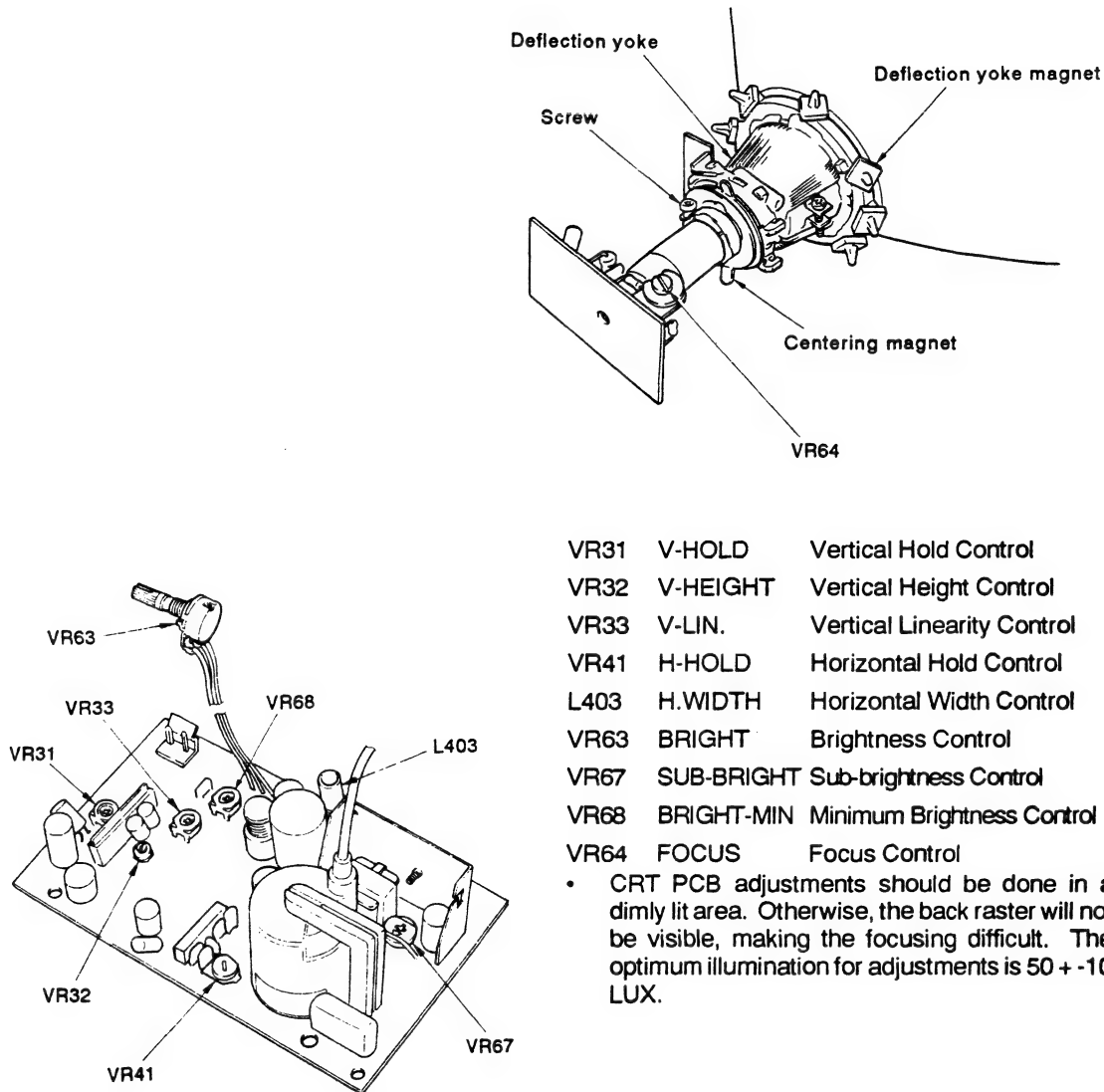
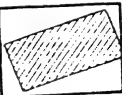
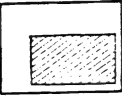
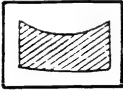

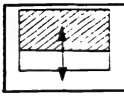
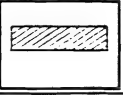
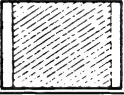
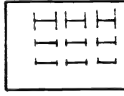
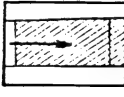
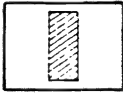
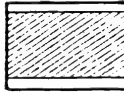
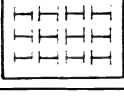
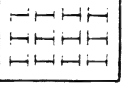


Fig. 16.10

(2) Phenomena and where to adjust

It is important to specify the point to be adjusted depending on the phenomenon.

Phenomenon	Cause	Section to be referred to	Item
The entire screen is tilted. 	1. Fitting of the CRT and front panel	Fitting of the CRT and front panel	3-1
	2. Inclination of the deflection yoke	Adjustment of the deflection yoke	3-1
The entire screen is moved to the side. 	Failure in centering	Adjustment of the centering magnet	3-2
The screen is distorted.  	1. A strong magnet near the CRT	Move to a different place	
	2. Failure of the deflection magnet yoke	Adjustment of the deflection yoke magnet	3-3
The screen is too bright or too dark when VR68 is turned to the minimum.	Maladjustment of VR68	Adjustment of the minimum brightness	3-4
The entire screen is too bright or too dark.	Maladjustment of VR67	Adjustment of the maximum brightness	3-5
The screen moves up and down continuously. 	Maladjustment of VR31	Adjustment of the synchronization	3-6
The screen shrinks or spreads in the vertical direction.  	Maladjustment of VR32	Adjustment of the screen size	3-7
The size of the characters differs at the top and the bottom. 	Maladjustment of VR33	Adjustment of the vertical linearity	3-8
The screen moves sideways continuously or is moved to one side. 	Maladjustment of VR41	Adjustment of the synchronization	3-6
The screen shrinks or spreads in the horizontal direction.  	Maladjustment of L403	Adjustment of the screen size	3-7
The entire screen is faded. 	A gap between the deflection yoke and CRT	Attaching and detaching of the deflection yoke	3-1
A part or whole of the screen is faded. 	Maladjustment of VR64	Adjustment of the focus	3-9

- See "THEORY OF OPERATION of the ELECTRONICS PART" for repairs in case the adjustments above are not satisfactory or phenomena other than above arise.
- Wait 10 to 20 minutes after the power is turned on before adjustment.

(3) Adjustment

(3-1) Deflection yoke

- a. Select "2" on the menu screen. "H-PATTERN" is displayed on.

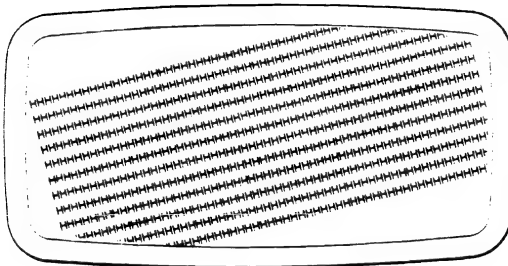


Fig. 16.11

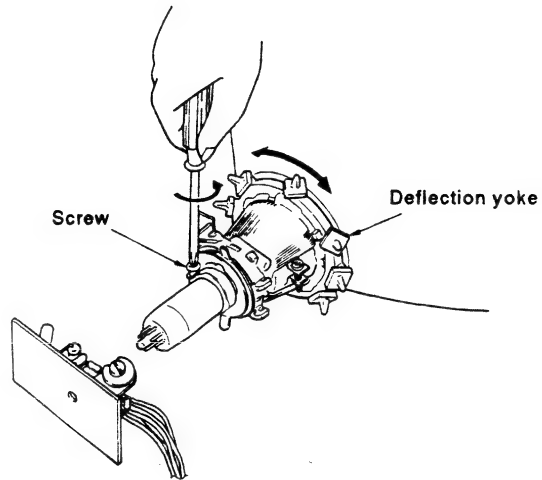


Fig. 16.12

- b. Loosen the screw securing the deflection yoke. Then, put on thin gloves and turn the yoke by hand until the display becomes level. In this case, adjust so that the difference between the distance L1 and L2 is 2.3 mm or less.

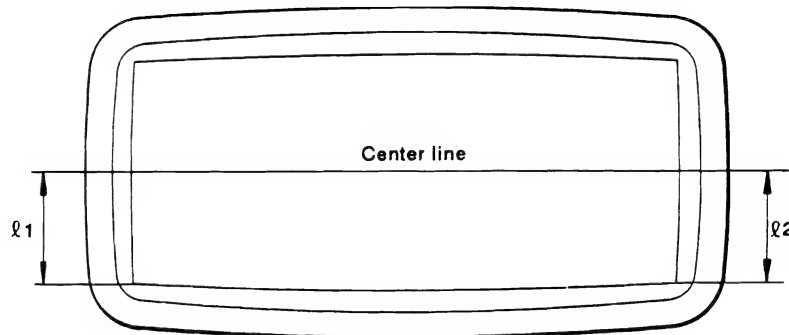


Fig. 16.13

- c. After adjustment, retighten the screw (torque: 4 kg/f).
- Push the deflection yoke against the CRT when assembly.
- d. As the last step, resin on the joint block between the CRT and the deflection yoke to prevent from slipping off.

(3-2) Centering magnet

- a. Select "2" on the menu. "H-PATTERN" is displayed on.

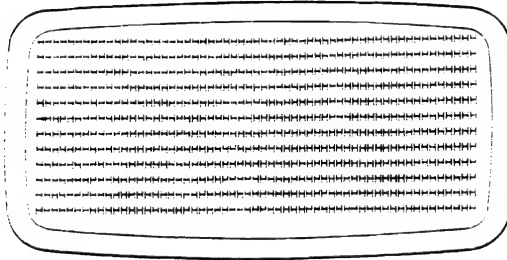


Fig. 16.14

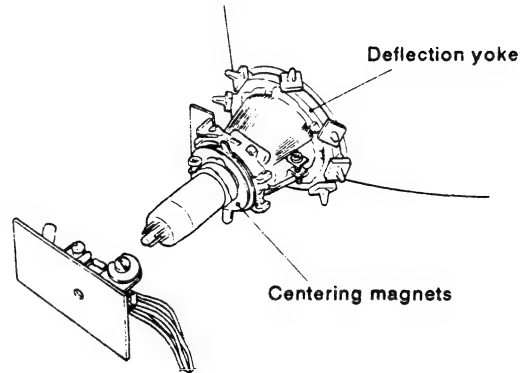


Fig. 16.15

- b. Turn the centering magnet so that the display is centered in the CRT.

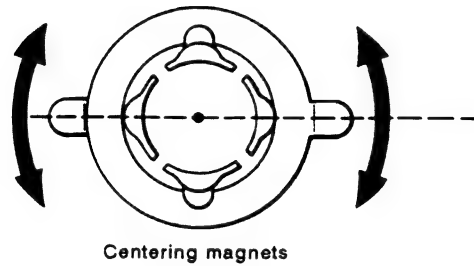


Fig. 16.16

- c. Adjustment standards are $|a1-a2| \leq 3 \text{ mm}$ and $|b1-b2| \leq 3 \text{ mm}$.

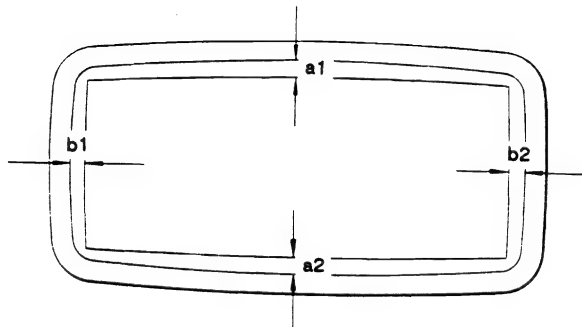


Fig. 16.17

- d. After adjustment, fasten the centering magnet with lock paint.

(3-3) Deflection magnet

- a. Select "1" on the menu screen. "FRAME" is displayed on.

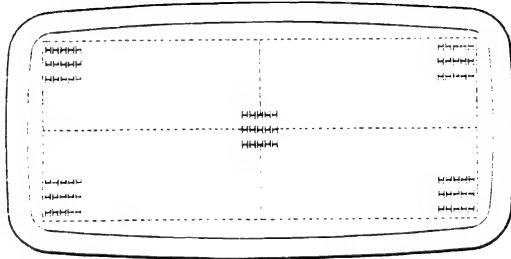


Fig. 16.18

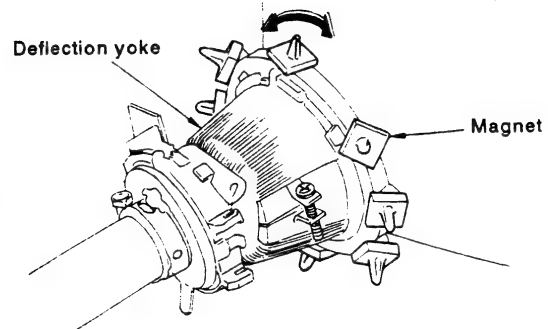


Fig. 16.19

- b. Turn the deflection magnet so that the distortion on the screen disappears.
- c. Adjustment standards are
- $b1, b1' \leq 1.5 \text{ mm}$
 - $b2, b2' \leq 1.2 \text{ mm}$
 - $c1, c1' \leq 1.5 \text{ mm}$
 - $c2, c2' \leq 1.2 \text{ mm}$

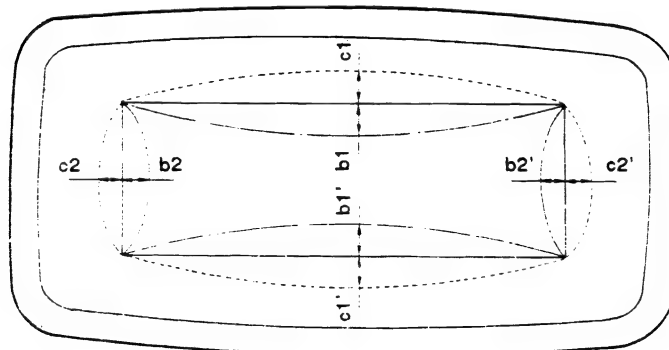


Fig. 16.20

- d. After adjustment, fasten the deflection yoke magnet with lock paint.
- To make this adjustment accurately, the brightness should be adjusted. If there is a luminance meter, adjust VR63 so that the brightness will be 60 nit. If not available, adjust VR63 to nearly the center. In this case, rotate VR63 approx. 270 degrees.

(3-4) Adjustment of minimum brightness

- a. Select "2" on the menu screen. "H-PATTERN" is displayed on.
 - b. Rotate VR63 for minimum brightness.
 - c. Rotate VR68 to the position where the characters displayed on the screen are slightly seen.
- The CRT display is used also as the power indicator. Therefore, the screen should show the display slightly even at the state of minimum brightness.
 - The maximum brightness will not change even if the minimum brightness level is adjusted.

(3-5) Adjustment of maximum brightness

- a. Select "2" on the menu screen. "H-PATTERN" is displayed on.
 - b. Rotate VR63 for maximum brightness.
 - c. Rotate VR67 to adjust the maximum brightness
 - d. If the brightness is raised too much, each dot that composes characters expand, making the entire screen size too big. In that case, make sure, after the adjustment, that the screen size is within the size mentioned in (3-7) adjustment of screen size. Here, VR32 and L403 should not be adjusted.
- To adjust the maximum brightness accurately, use a luminance meter to adjust the brightness to 180 nit. If the luminance meter is not available, repeat the steps c. and d. above.
 - Since the heat sink near VR67 possesses the collector voltage of Q44, it is very dangerous.
 - VR67 is used to make the brightness of the entire screen lighter and darker. This also means the minimum brightness will also change. If the minimum brightness of the screen does not appear to be clear enough as expected, adjust the minimum brightness as specified in (3-4) Adjustment of minimum brightness.

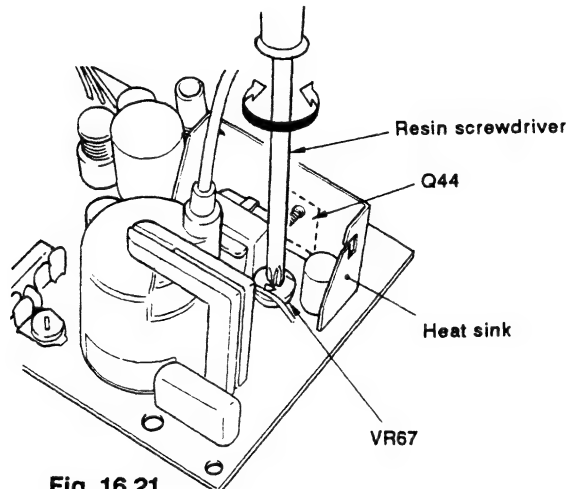
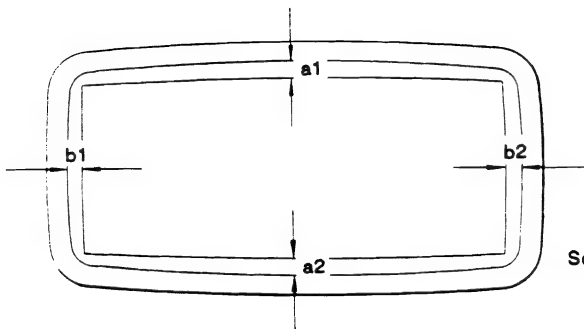


Fig. 16.21

(3-6) Adjustment of synchronization

- a. Select "2" on the menu screen. "H-PATTERN" is displayed on.
- b. If the screen rolls vertically, for instance, from top to bottom, rotate VR31(V-HOLD) until the screen starts rolling in opposite direction. Then rotate VR31(V-HOLD) in the opposite direction once again so that the screen stabilizes. Set VR31(V-HOLD) in the exact center between the points adjusted above.
- c. If the screen moves horizontally, for instance, from right to left, rotate VR41(H-HOLD) until the screen starts moving in opposite direction. Then rotate VR41(H-HOLD) in the opposite direction once again so that the screen stabilizes. Set VR41(H-HOLD) in the exact center between the points adjusted above.
- d. If the screen does not align with the center of the CRT display, align it to the center according to "(3-1) Adjustment of centering magnet."



Adjustment standards are
 $|a1-a2| \leq 3 \text{ mm}$ and $|b1-b2| \leq 3 \text{ mm}$.

Fig. 16.22

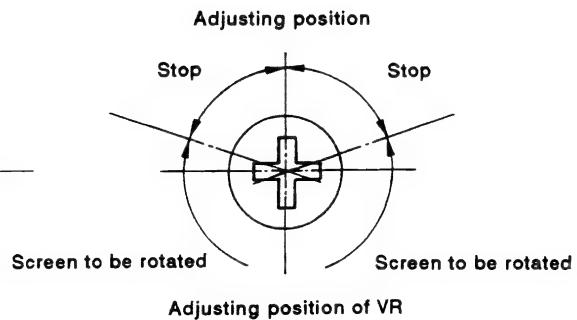


Fig. 16.23

(3-7) Adjustment of screen size

- a. Select "2" on the menu screen. "H-PATTERN" is displayed on.
- b. Rotate VR63(BRIGHT) to almost the center.
- c. Adjust the screen size in vertical direction with VR32(V-HEIGHT). Adjustment standard is 72 ± 3 mm. To adjust L403(H-WIDTH), use a hexagonal wrench. If a hexagonal wrench is not available, an alignment screwdriver may be used. In that case, turn L403 slowly, being careful not to exert undue force and damage the inner core of L403.

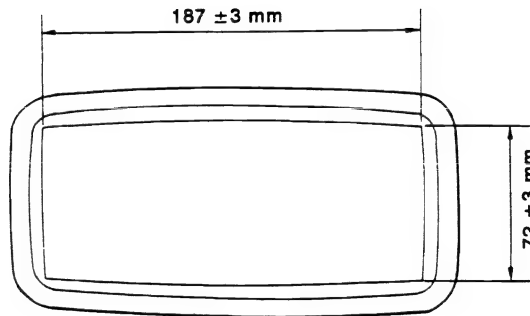


Fig. 16.24

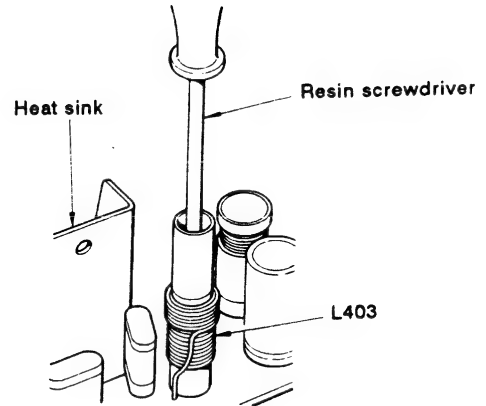


Fig. 16.25

- To make this adjustment accurately, it is necessary to set the brightness to 60 nit. If the luminance meter is not available, rotate VR63(BRIGHT) to nearly the center to set the brightness to 60 nit for adjustment.

(3-8) Adjustment of verticality and linearity

- a. Select "1" on the menu screen. "FRAME" is displayed on.
- b. Adjust VR33(V-LINE.) so that l1 and l1', and l2 and l2', etc. are equal.

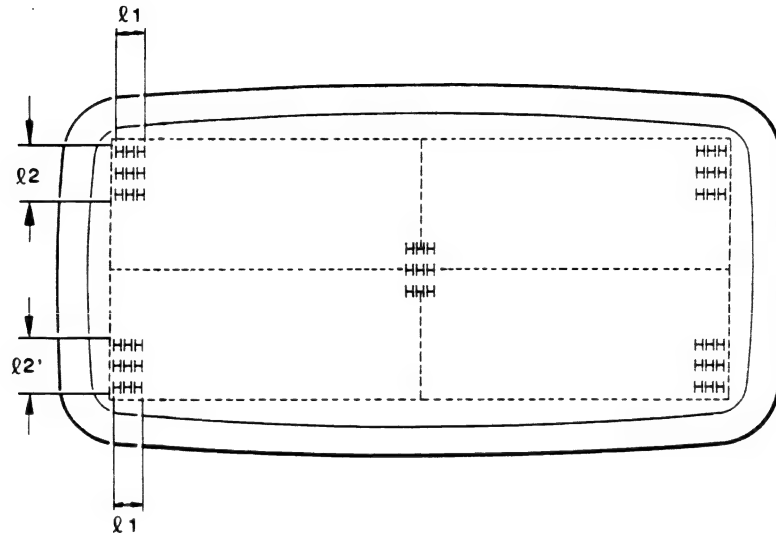


Fig. 16.26

(3-9) Adjustment of focus

- a. Select "4" on the menu screen. "H-BLOCKS" is displayed on.
- b. Rotate VR63(BRIGHT) to the maximum brightness.
- c. Put on a pair of light gloves and adjust VR64(FOCUS) by hand, taking care to avoid being shocked. Pay attention to the areas around point A and point B on the screen, ensuring that those areas provide the best focus. In the optimum focus point is located in the center of the screen, the focus for the surrounding areas will gradually worsen.

d. After adjustment, fasten VR64 with a lock paint.

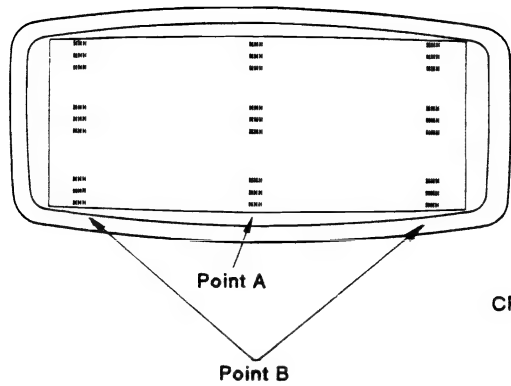


Fig. 16.27

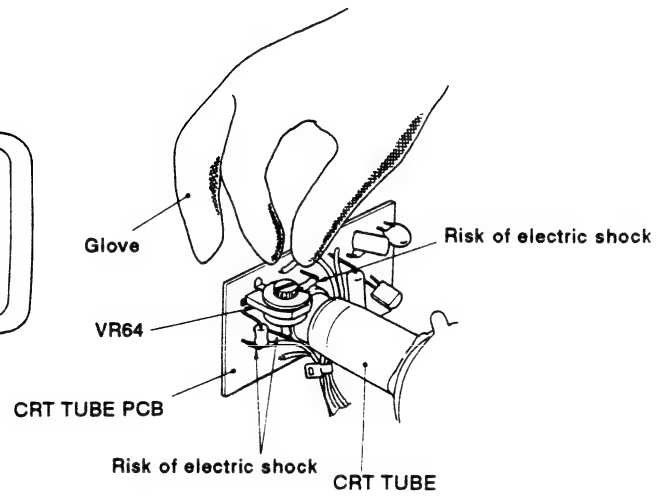


Fig. 16.28

17. FLOPPY DISK DRIVE (FDD) UNIT

17.1. Disassembly

- (1) Remove the front panel.

See "14. FRONT PANEL."

- (2) Remove the FDD holder

See "15. SUB-CHASSIS UNIT AND FDD HOLDER."

- (3) Remove the FDD unit.

Remove the two screws securing the FDD unit and disassemble it from the FDD holder.

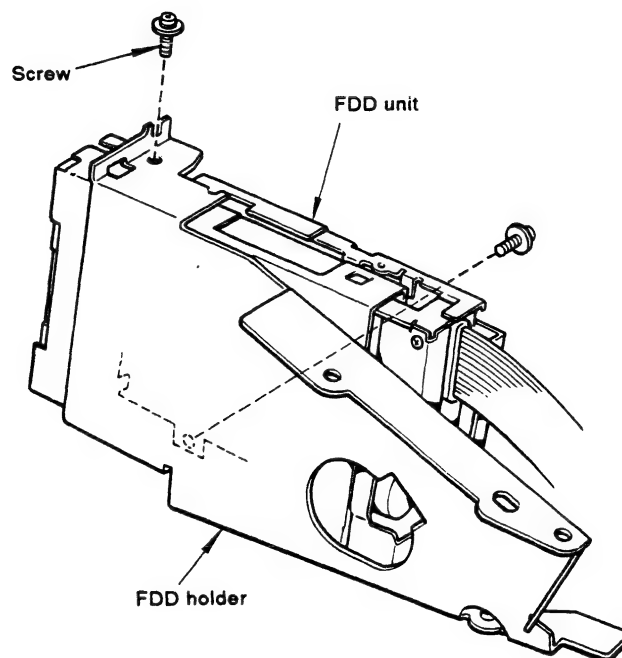


Fig. 17.1

(4) The FDD unit consists of the following parts.

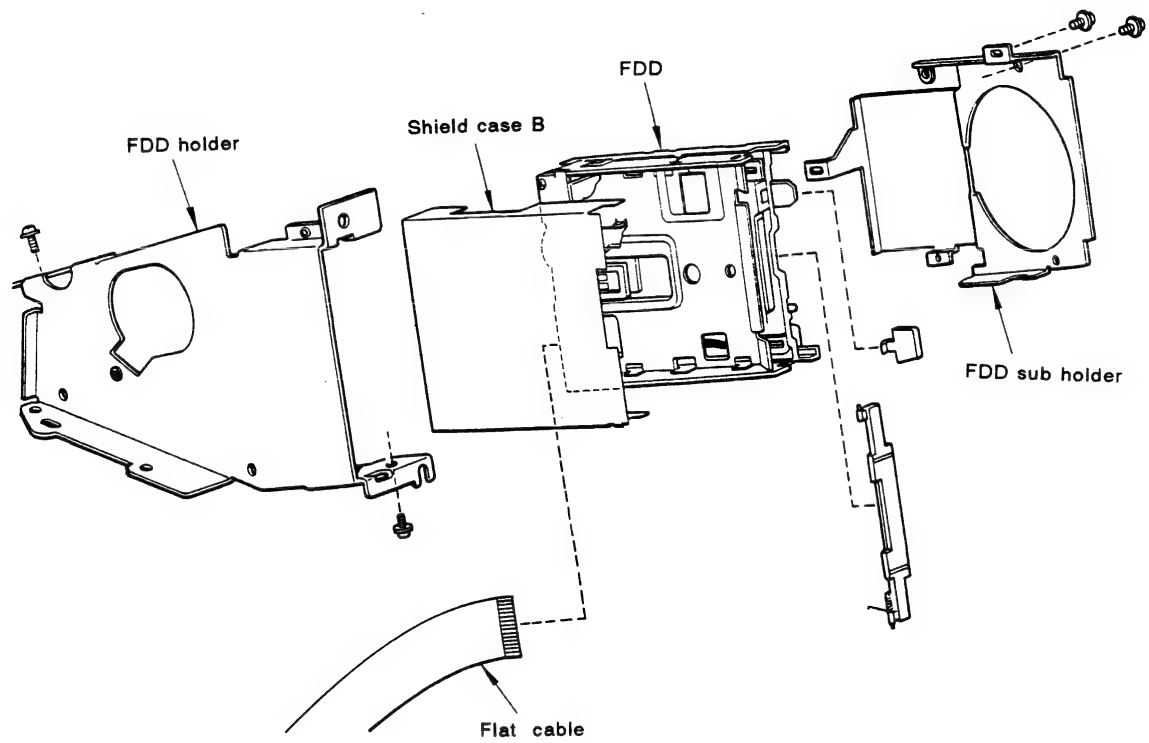


Fig. 17.2

18. FILTER PCB

18.1. Disassembly

- (1) Remove the chassis unit.

See "3. CHASSIS UNIT."

- (2) Remove the cord keeper.

Unscrew the two screws holding the cord clamp to the bottom cover for removal.

- (3) Remove the filter PCB.

Disconnect the connector from the transformer and unscrew the screw securing the filter PCB to the bottom cover. Then, remove the filter PCB together with the PCB cover by sliding it up and to the left.

- (4) Remove the PCB cover from the filter PCB.

18.2. Reassembly

- (1) Reassemble the filter PCB.

a) Insert the power switch into the opening in the bottom cover without attaching the power supply cover to the filter PCB. The power core should then be stored in the bottom cover.

b) Tighten the screw securing the filter PCB.

- (2) Attach the power supply cover.

Attach the power supply cover to the filter PCB while inserting one end of the cover into the opening on top of the power switch. (Fig. 18.4)

Connect the connector from the transformer to the filter PCB.

- (3) Reassemble the chassis unit.

If the power switch mounted on the filter PCB rides up (left side of Fig. 18.1), it does not fit to the square opening on the bottom cover. Correct the switch position as shown in Fig. 18.1 (right side).

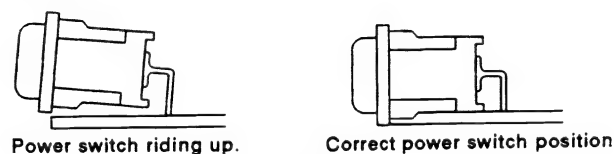


Fig. 18.1

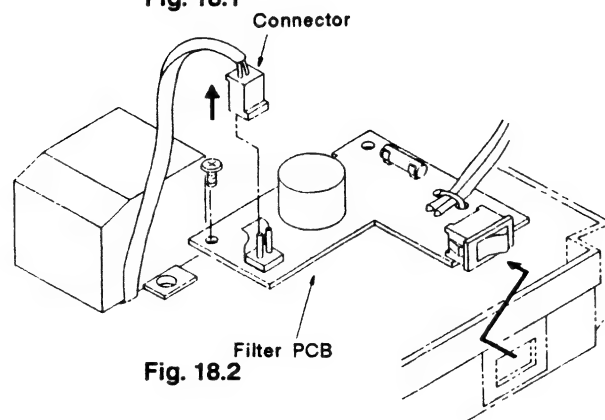


Fig. 18.2

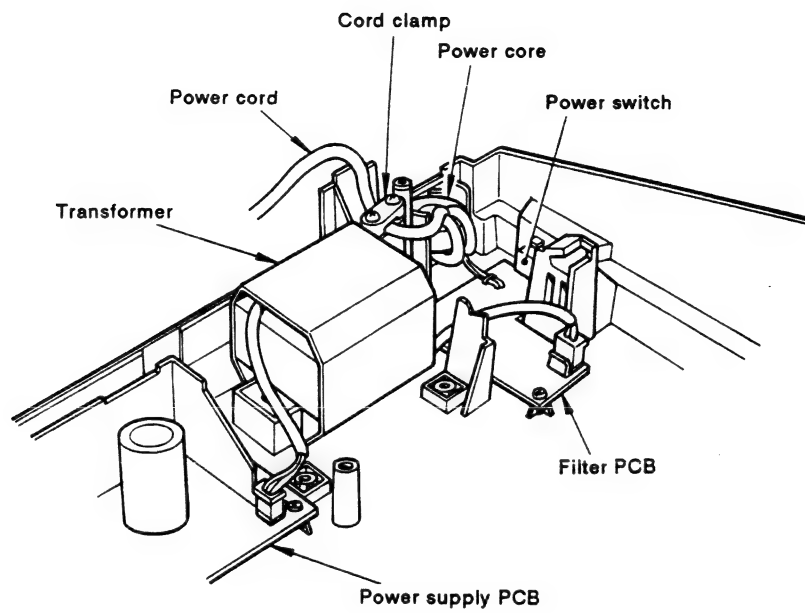


Fig. 18.3

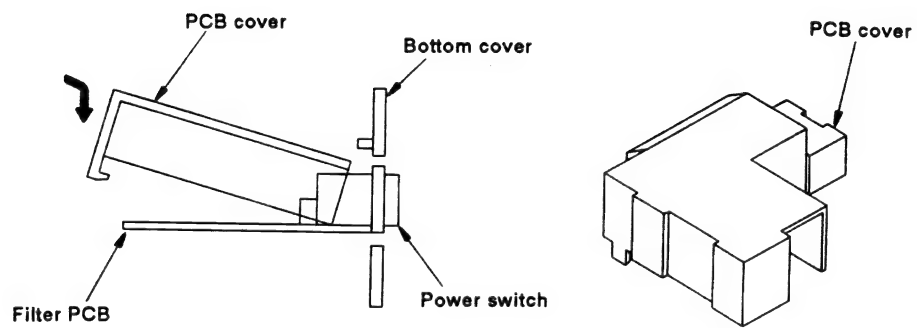


Fig. 18.4

19. POWER CORD

19.1. Disassembly

- (1) Remove the body cover.

See "1. COVER."

- (2) Remove the filter PCB.

See "18. FILTER PCB."

- (3) Remove the power cord.

Unsolder the connections on the filter PCB and disconnect the power cord.

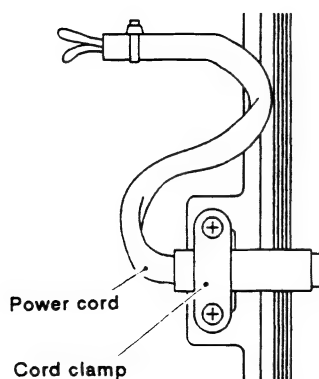
19.2. Reassembly

To reassemble the power cord and the AC wire, reverse the order of disassembly.


Note 1 : Connect the wires to the filter PCB following the N and L markings on them.

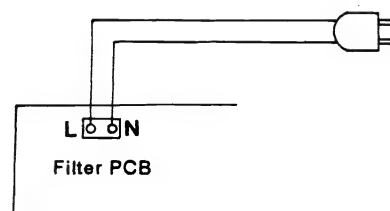
Note 2 : Tighten the screw holding the cord clamp matching the previous screw threads.

Note 3 : When the power core is removed, the power cord should be wound around the core three times.



When connecting the power cord the power supply PCB, connect N (Neutral) and L (Live) wire to their corresponding points, on the PCB. ("N" and "L" are written on the PCB.)

Specifications	Power cord	
U.S.A Canada	L	(L  N)
	N	(Sectional view of cord)
Europe (Except West Germany)	L	Brown
	N	Blue
West Germany	L	Brown
	N	Blue
	L	
	N	
	L	
	N	



20. POWER SUPPLY PCB

20.1. Disassembly

- (1) Removal of the chassis unit.

See "3. CHASSIS UNIT."

- (2) Disconnection of the connectors.

Disconnect the following cable connectors.

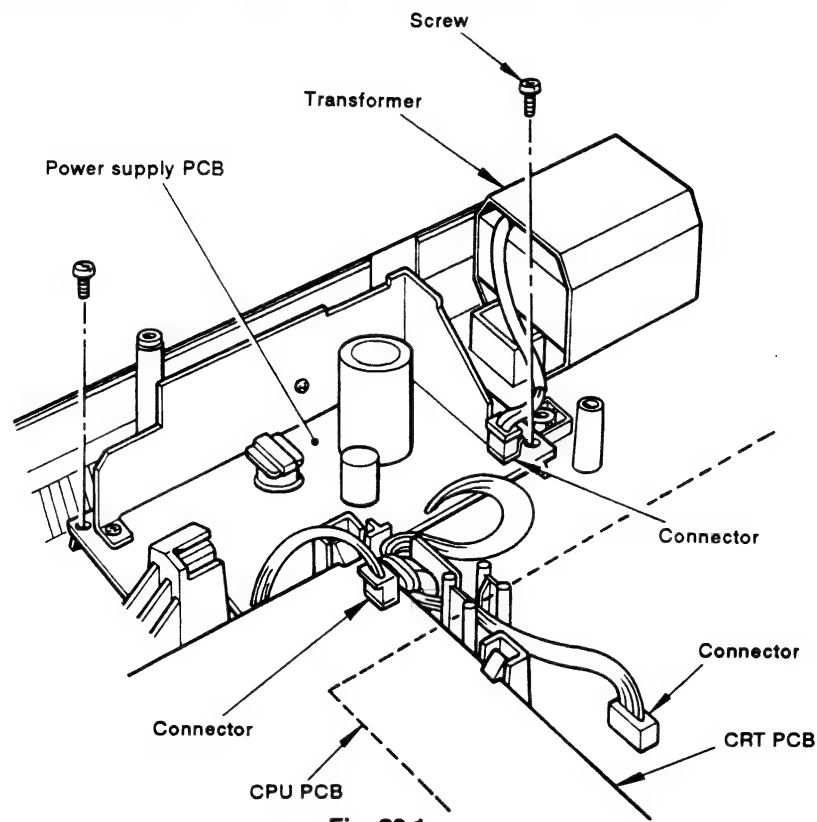
- a) Disconnect the connector from the transformer to the power supply PCB.
- b) Disconnect the connector from the power supply PCB to the CRT PCB.
- c) Disconnect the connector from the power supply PCB to the CPU PCB.

- (3) Removal of the power supply PCB.

Unscrew the two screws securing the power supply PCB to the bottom cover and slide the power supply PCB out on the side opposite the transformer for removal.

20.2. Reassembly

To reassemble the power supply PCB, reverse the order of disassembly.



21. KEYBOARD UNIT

21.1. Disassembly

- (1) Remove the front panel.

See "14. FRONT PANEL."

- (2) Remove the spacer.

Unhook and remove the tilt arm spacers from the keyboard tilt plates (R) and (L).

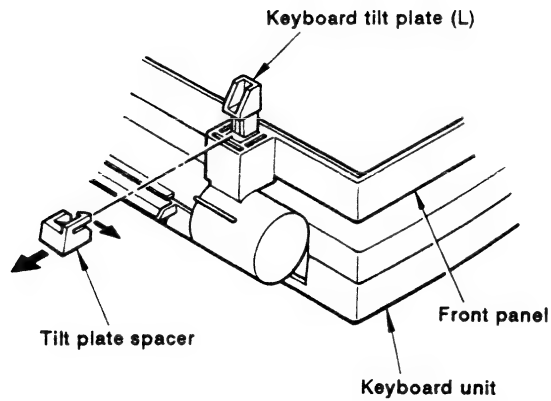


Fig. 21.1

- (3) Disconnect the keyboard unit from the front panel.

- (4) Remove the keyboard bottom cover.

Unscrew the six screws securing the keyboard bottom cover to the keyboard top cover and remove the keyboard bottom cover while pivoting it toward the rear of the keyboard.

- (5) Remove the keyboard tilt plates. (Fig. 21.2)

- (6) Remove the keyboard rocker.

Push the button of the keyboard rocker until it is released from the stopper of the keyboard bottom cover for removal. (Fig. 21.3)

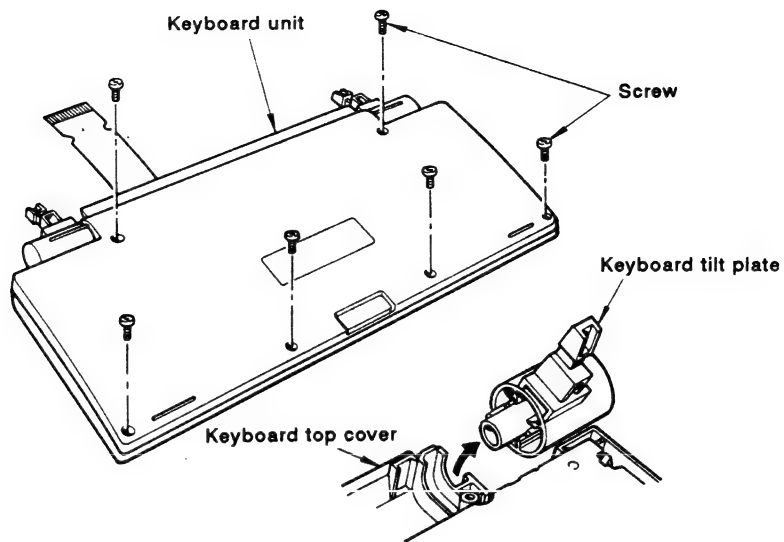


Fig. 21.2

21.2. Reassembly

To reassemble the keyboard unit, reverse the order of disassembly.

Be careful not to set the keyboard tilt plates inversely.

21.3. Check and Adjustment

- (1) Make sure that the keyboard top cover is securely engaged to the keyboard bottom cover and that there is no gap or misalignment between them.
- (2) Make sure that all the keys operate smoothly.

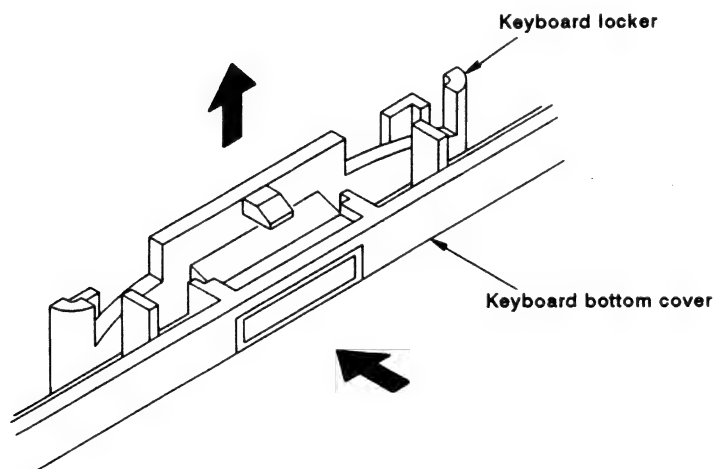


Fig. 21.3

22. FLEXIBLE PCB

22.1. Disassembly

- (1) Remove the keyboard unit.

See "21. KEYBOARD UNIT."

- (2) Remove the base plate.

Unhook the fourteen hooks and remove the fixing plate.

Note: Do not apply undue force to the hooks as this could break them.

- (3) Remove the flexible PCB, bent along the FPC holder, from the bottom of the FPC holder and unbend it.
- (4) Remove the flexible PCB.

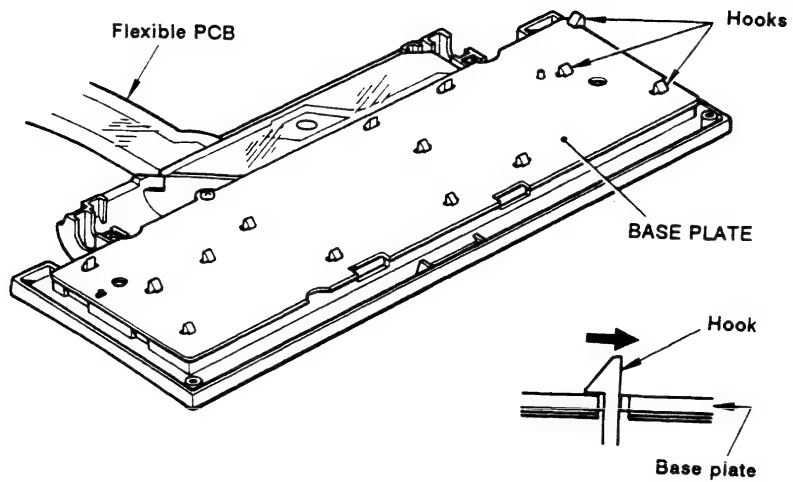


Fig. 22.1

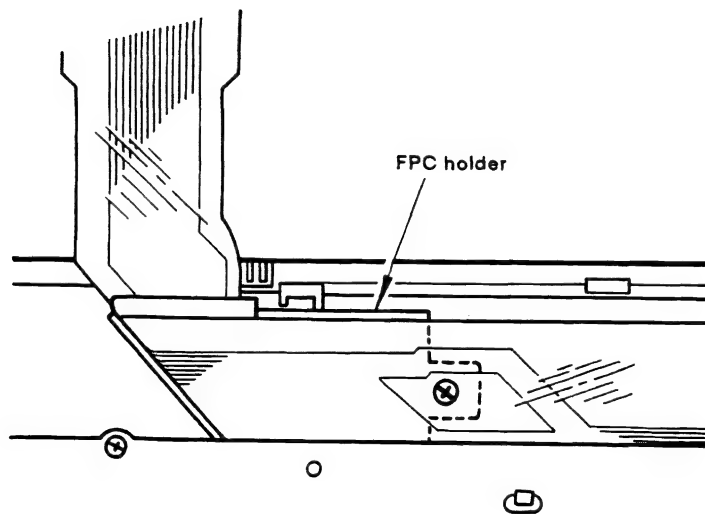


Fig. 22.2

22.2. Reassembly

To reassemble the flexible PCB, reverse the order of disassembly.

22.3. Check and Adjustment

Make sure that all the keys operate smoothly.

CHAPTER IV LUBRICATION STANDARDS

This section provides the lubrication specifications for the WP-1 β word processor. If the word processor is disassembled for parts replacement, adjustment or cleaning, be sure to lubricate the points which are listed using the appropriate lubricants before reassembling the unit.

1. LUBRICANTS

Lubricate the parts in the following figures with the lubricants specified below:

Symbol	Lubricant	*(Mobil Grease No. 1) : (Liqui-Moly booster)		
B	Grease B*	9	:	1
E	Epinoc grease #1			
S	Silicone grease KS64F			
SO	Silicone oil KF96-CS100			
SS	Silicone splay			

2. PRECAUTIONS

- (1) Lubricate carefully so that the oil or grease will not stick to places other than the specified points, otherwise the plastic parts and electronic boards will be adversely effected.

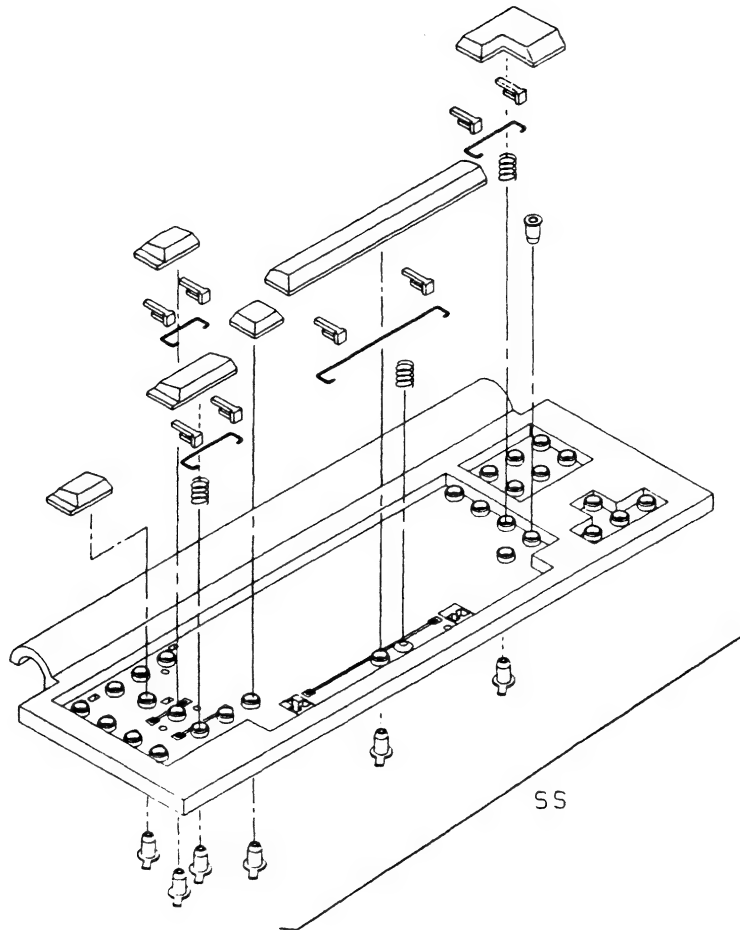
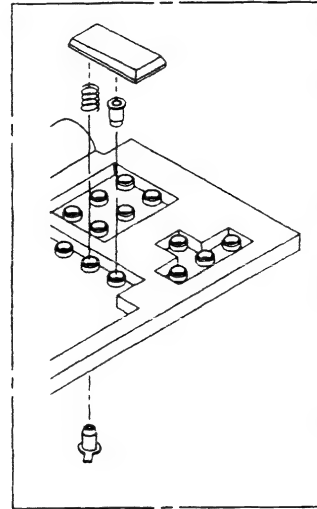
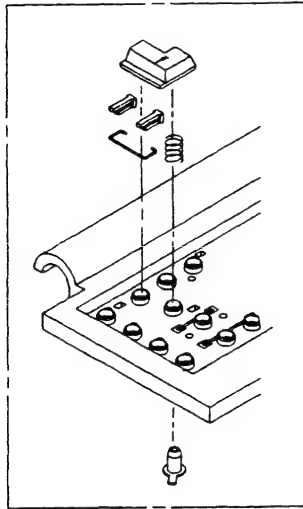
Do not apply an excessive amount of lubricant, otherwise the lubricant may drip onto places other than the specified lubrication points during use or storage.

- (2) Make sure to apply a sufficient amount of lubricant to contact parts and sliding surfaces consisting of more than one material.

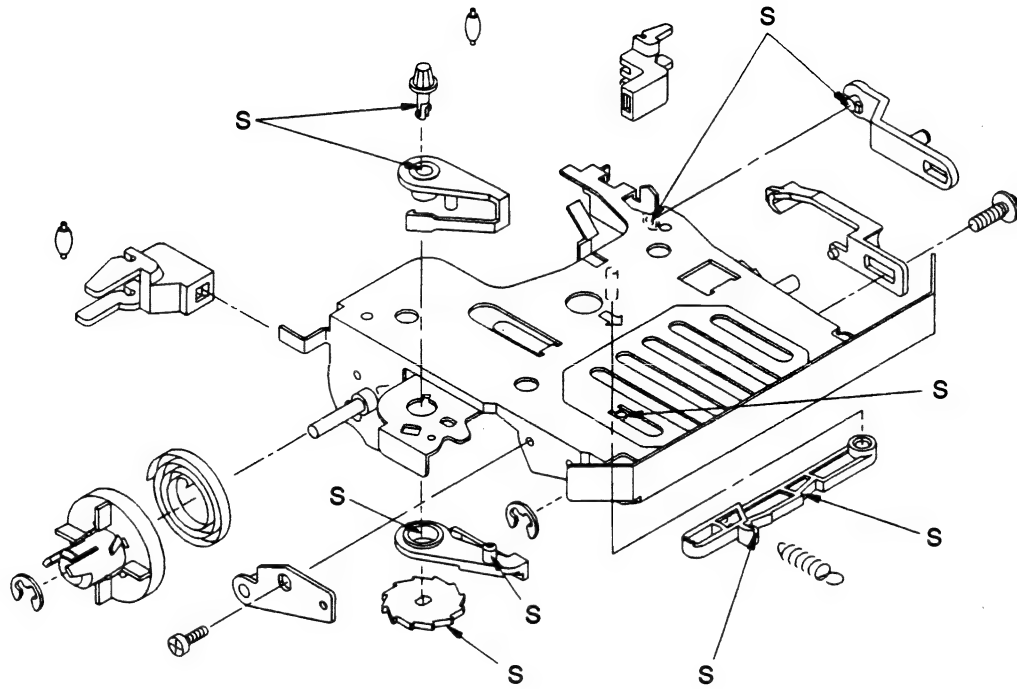
3. LUBRICATION POINTS AND LUBRICANTS

3.1. Keyboard

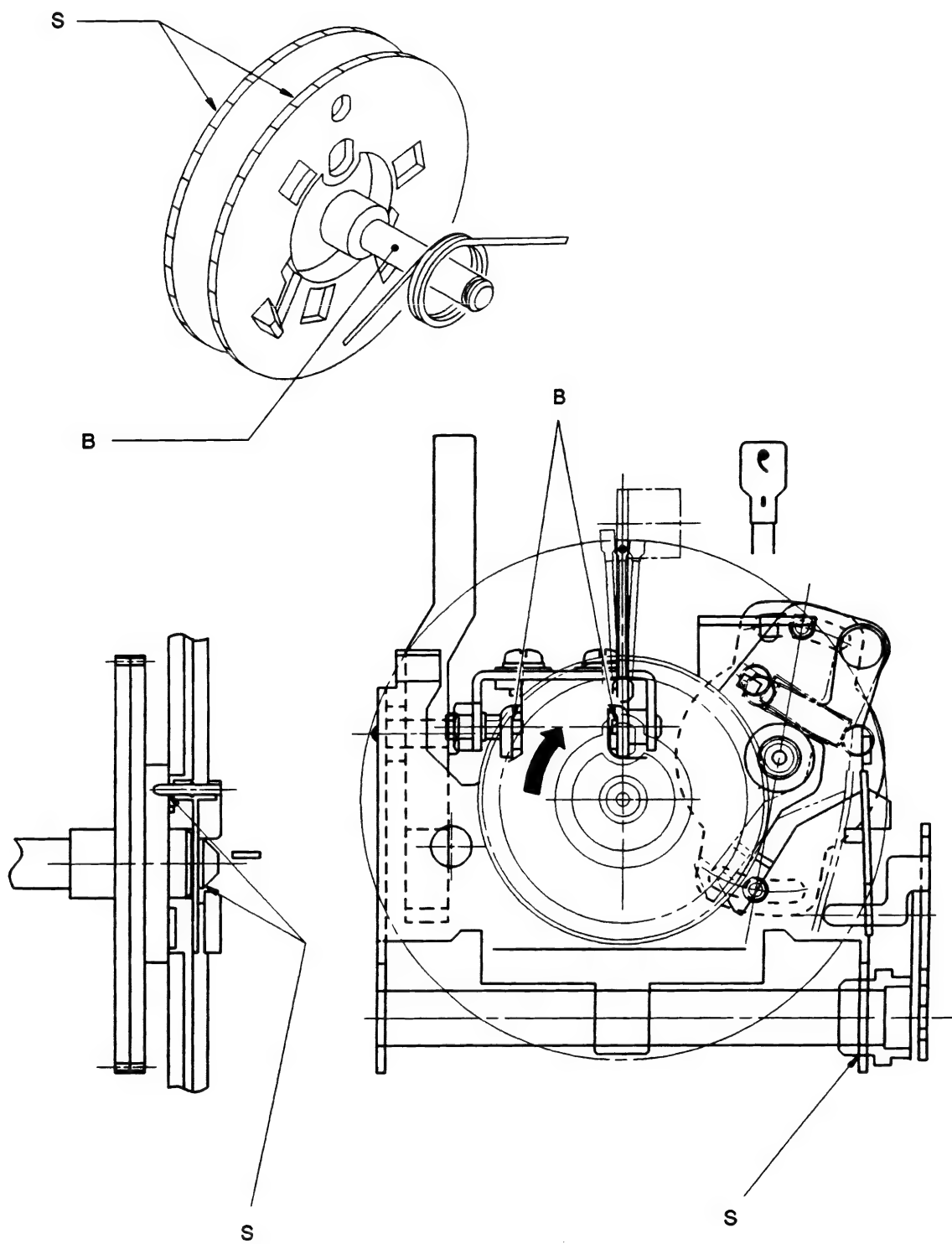
Apply silicone spray to entire area of the key stem insert portion in the keyboard panel.
(from back side)



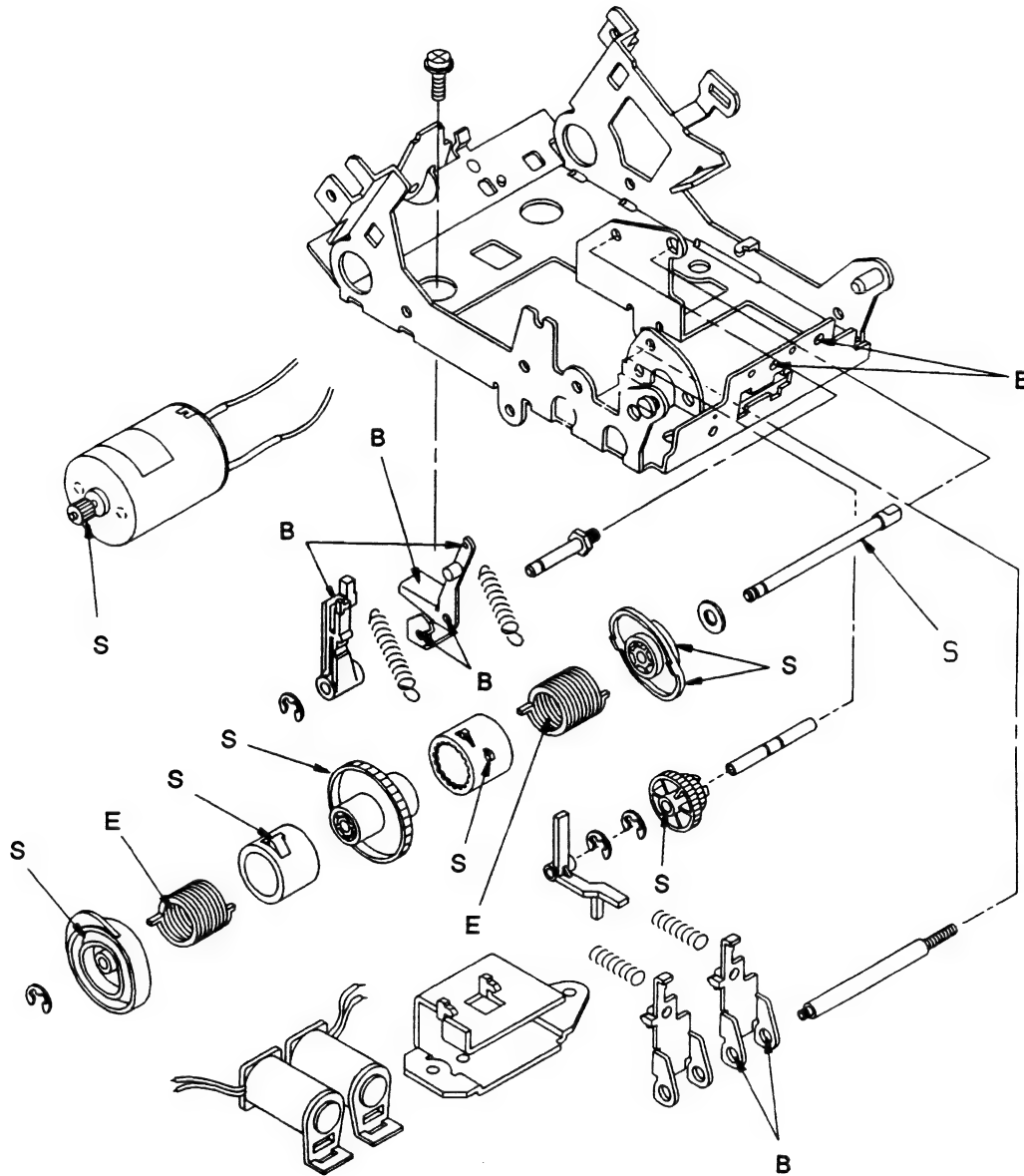
3.2. Carrier Mechanism (1)



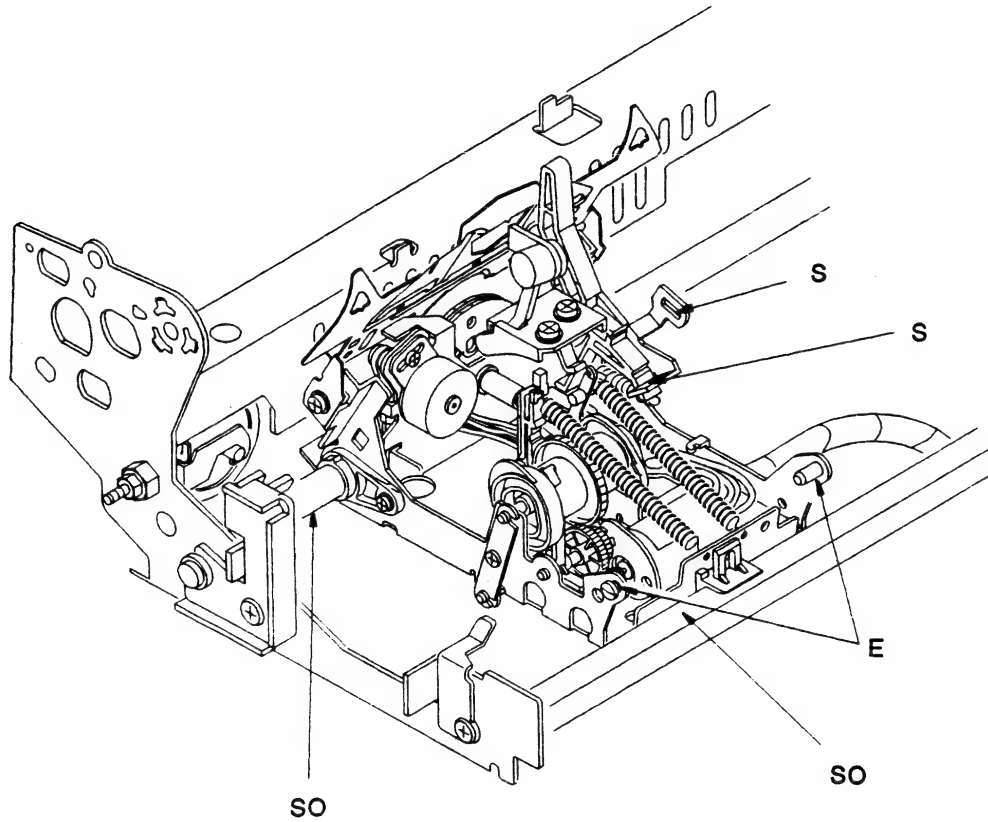
Carrier Mechanism (2)



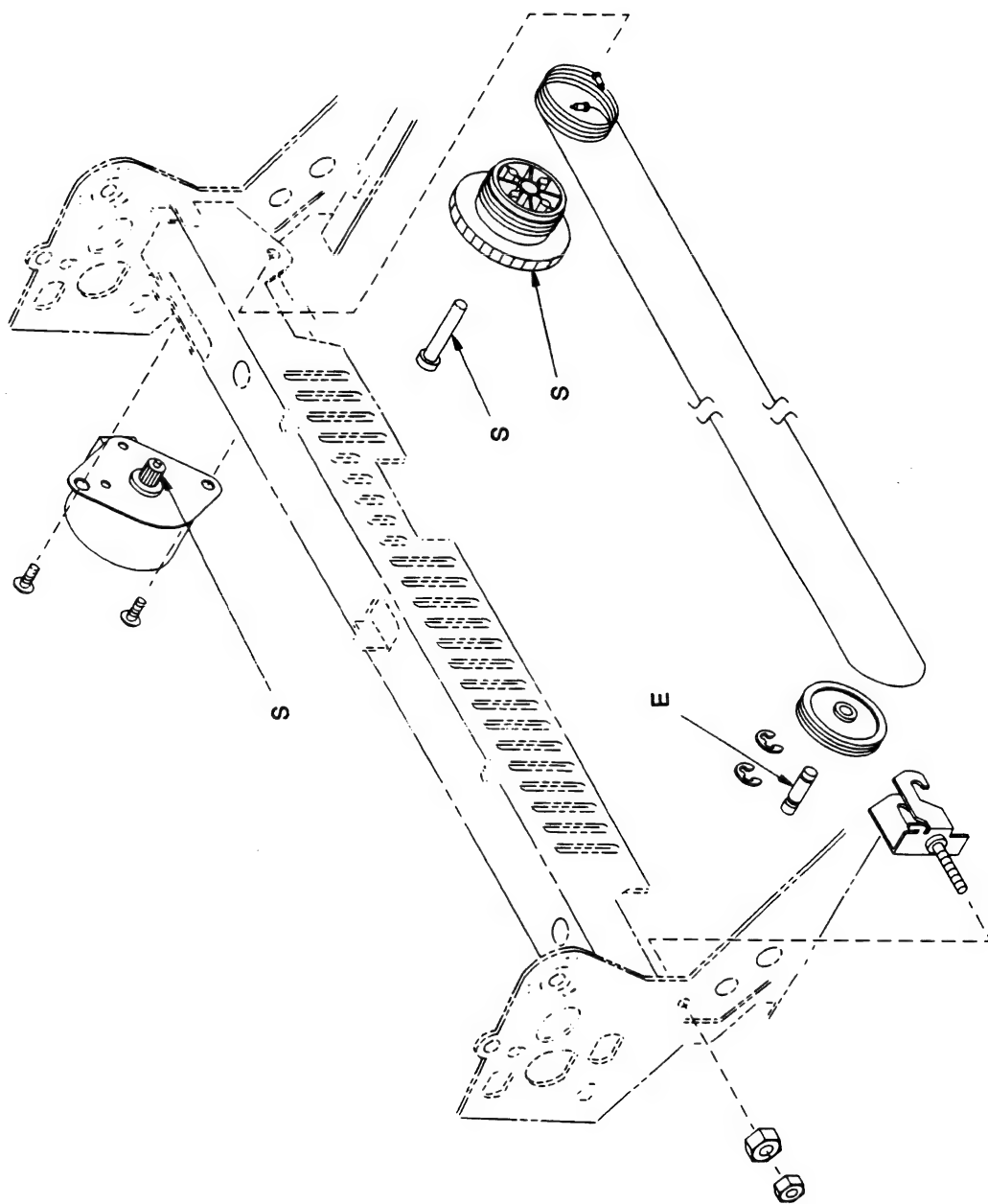
Carrier Mechanism (3)



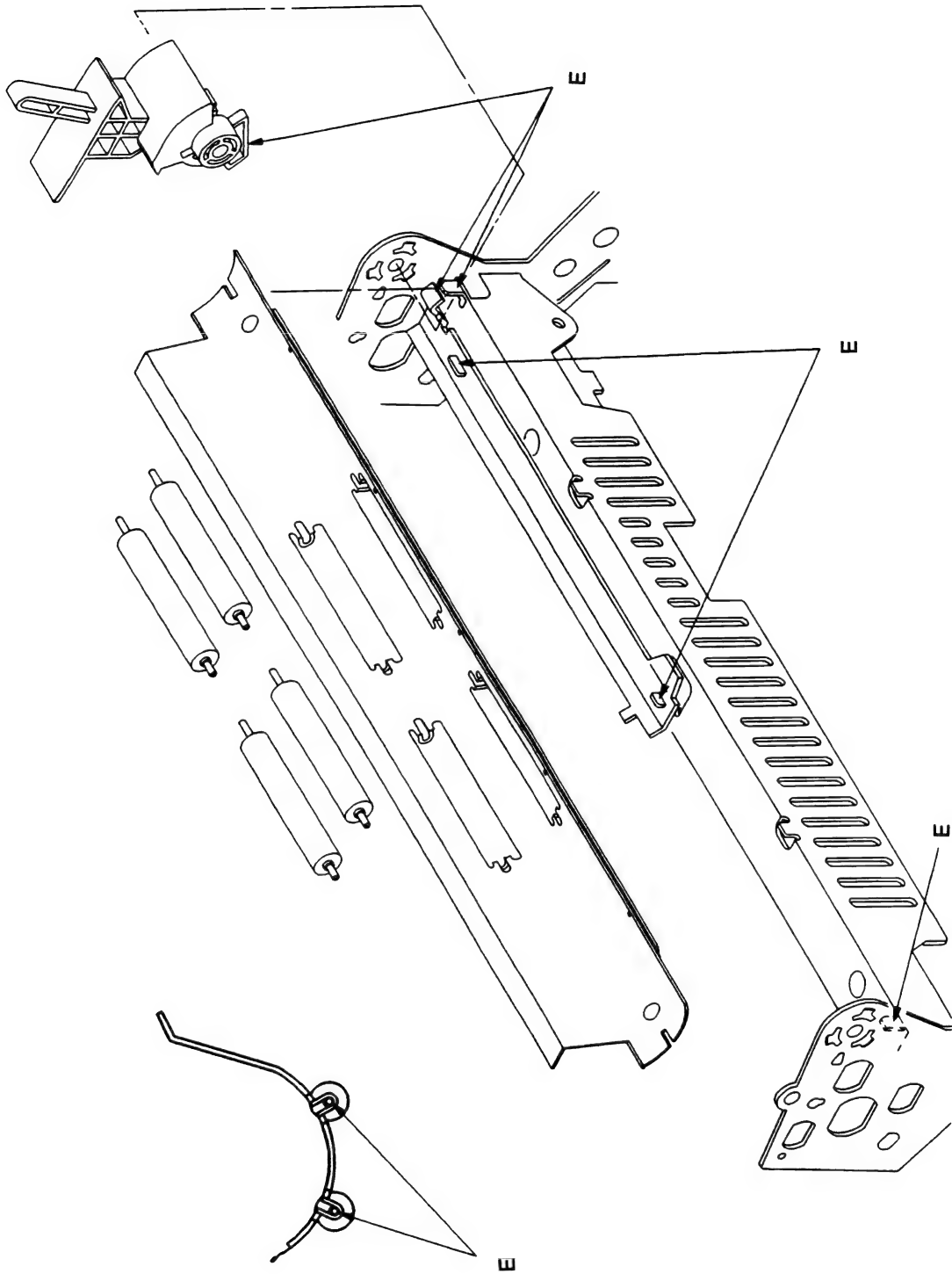
3.3. Carrier Drive Mechanism (1)



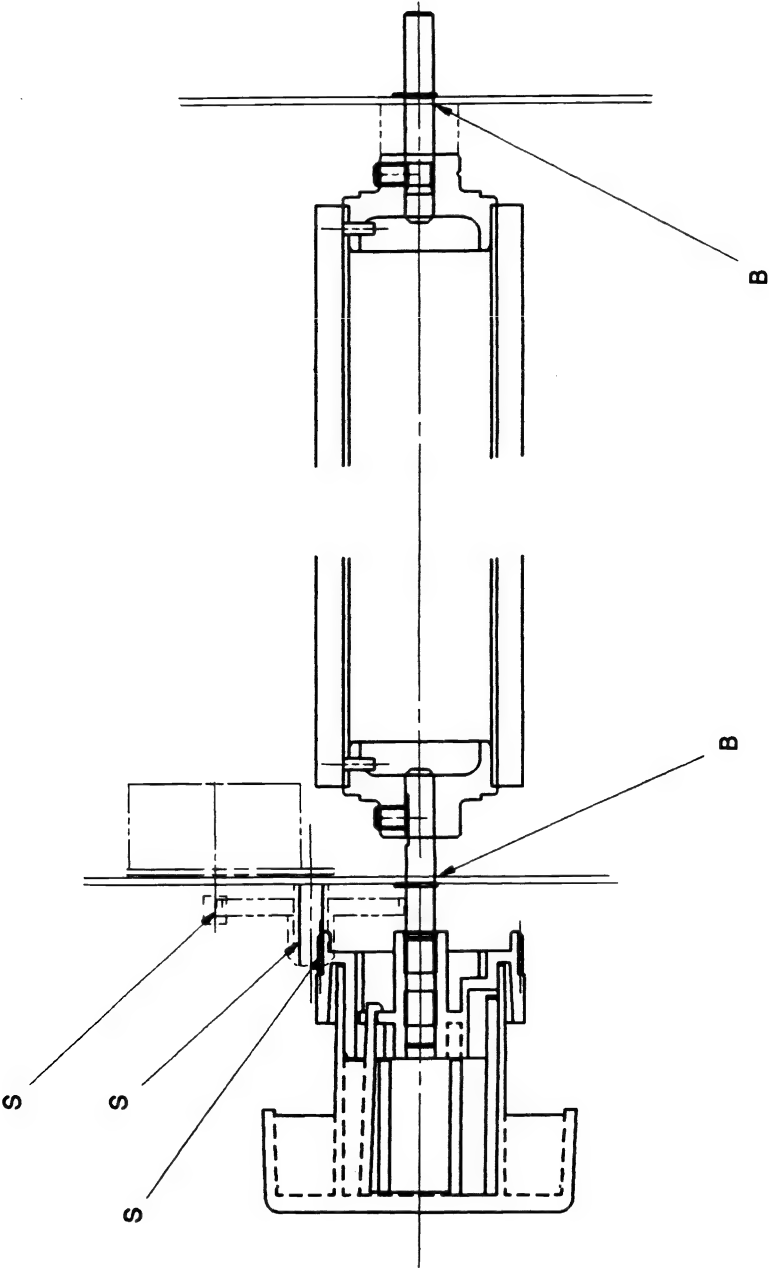
Carrier Drive Mechanism (2)



3.4. Platen Mechanism (1)



Platen Mechanism (2)



WORD PROCESSOR SERVICE MANUAL

(ELECTRONIC PART)

Contents

CHAPTER I THEORY OF OPERATION

1.	GENERAL	2
1.1.	Configuration of Electronic Section	2
1.1.1.	Filter PCB	2
1.1.2.	Power Supply PCB	2
1.1.3.	Control PCB	2
1.1.4.	Keyboard PCB (Material: FPC)	2
1.1.5.	CRT unit	2
1.1.6.	FDD unit	2
1.2.	Operational Outline of the Motors, Magnets and Switches	3
1.2.1.	Wheel motor	3
1.2.2.	Carrier motor	3
1.2.3.	LF motor	3
1.2.4.	DC motor	3
1.2.5.	Ribbon magnet	3
1.2.6.	Correction magnet	3
1.2.7.	Carrier home-position switch	3
1.2.8.	Cover switch	3
2.	CONTROL PCB AND PERIPHERALS	4
2.1.	Configuration	4
2.1.1.	CPU (#3)	5
2.1.2.	ROM (#6)	5
2.1.3.	RAM (#7)	5
2.1.4.	Gate Array (#2)	5
2.1.5.	Drive Circuit	5
2.1.6.	Video RAM (#4)	5
2.2.	CPU Peripherals	6
2.2.1.	Memory Map	6
2.2.2.	I/O map	7
2.2.3.	Clock Circuit	8
2.2.4.	Reset Circuit	9
2.2.5.	Specification change-over	10
2.2.6.	Buzzer drive circuit	10
2.2.7.	ROM configuration mode change-over	11
2.3.	Control of the Motors, Magnets and Switches	12
2.3.1.	Wheel motor control	12
2.3.2.	DC motor control	14
2.3.3.	Ribbon magnet control	15
2.3.4.	Correction Magnet Control	16
2.3.5.	DC motor peripheral control	18
2.3.6.	Carrier motor control	19
2.3.7.	LF motor control	21
2.3.8.	Carrier index switch and cover switch	23
2.3.9.	Home position recovery systems	24
2.4.	Keyboard PCB	25
2.4.1.	Keyboard configuration	25
2.4.2.	Keyboard scan	25
2.4.3.	Keyboard control circuit	26

3.	CRT UNIT	28
3.1.	Logic Level Signal Generation Circuit	28
3.1.1.	Outline	28
3.1.2.	Relationship between VIDEO RAM and Screen Display	31
3.1.3.	VIDEO RAM #4 Access	32
3.1.4.	CRT display timing chart	33
3.2.	CRT Drive	34
3.2.1.	Theory of CRT display operations	34
3.2.2.	Details of the CRT components	35
4.	FLOPPY DISK DRIVE (FDD) CONTROL	41
4.1.	Configuration of the FDD Electronic Parts	45
4.1.1.	FDC #1	41
4.1.2.	Gate Array #2	41
4.2.	FDD Operation	46
4.2.1.	FDD Basic Operations	42
4.2.2.	Interface between CPU #3 and FDC #1	42
4.3.	Interface Signals	43
4.3.1.	FDD Unit ← FDC Signal	44
4.3.2.	FDD Unit → FDC Signal	45
4.4.	FDD Unit	46
5.	POWER SUPPLY UNIT	47
5.1.	Configuration	47
6.	SELF-TESTING	49
6.1.	Type of Tests	49
6.2.	Self-printing Mode	50
6.3.	ROM and RAM check	52
6.4.	Self-testing (Mode 1)	52
6.4.1.	General	52
6.4.2.	CRT screen tests	53
6.4.3.	Printing tests	56
6.4.4.	Keyboard tests	58
6.4.5.	Detent check	59
6.4.6.	CR/LF check	60

CHAPTER II TROUBLESHOOTING

1.	General	61
2.	Precautions	61
3.	Checking After Repair	61
4.	Primary Check Items	61
5.	Troubleshooting Flowcharts	62
6.	Error Modes	64
7.	Error Mode Analysis Tables	65

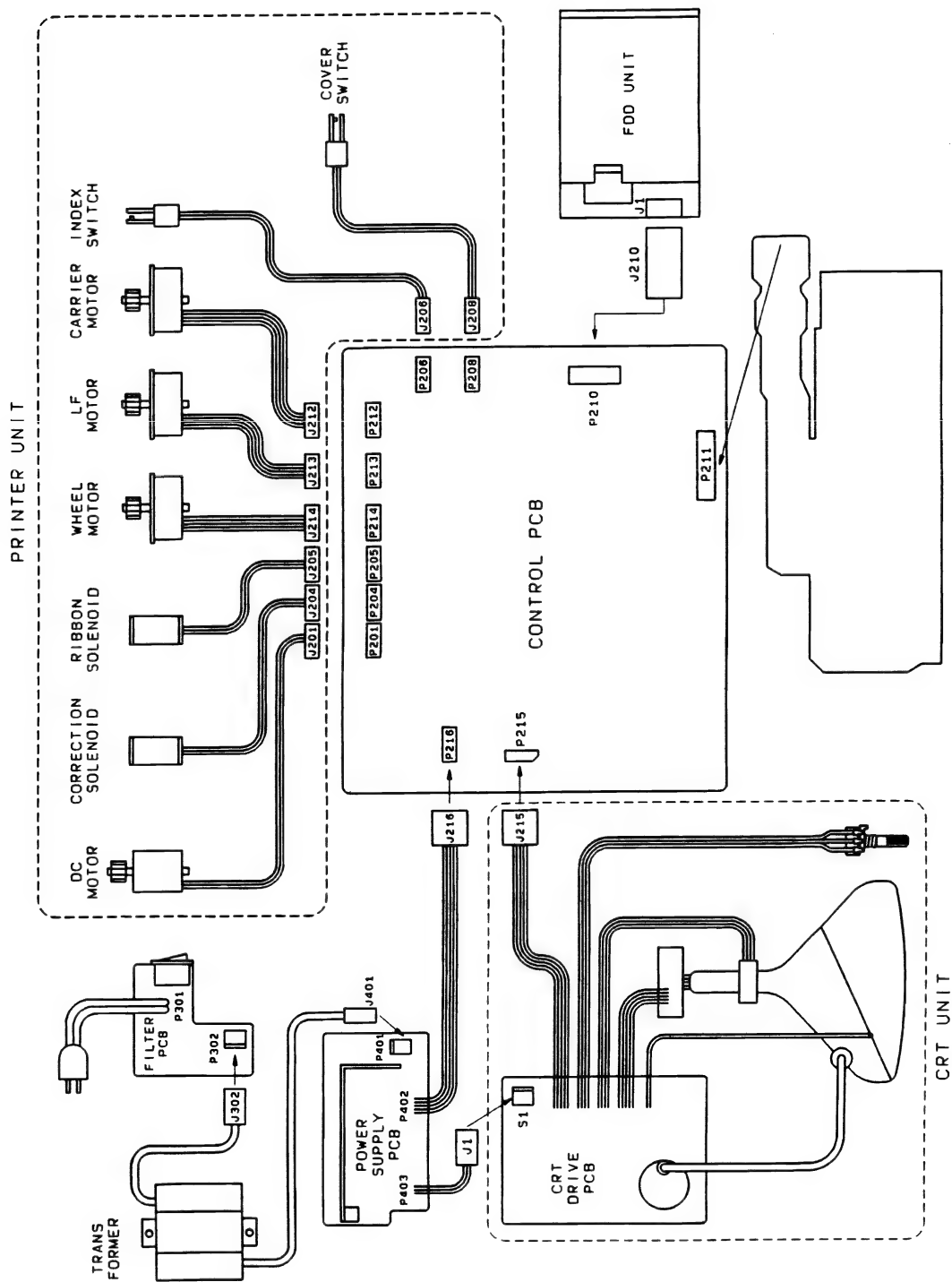


Fig. 1.1 Configuration of Electronic Section

CHAPTER I THEORY OF OPERATION

1. GENERAL

1.1. Configuration of Electronic Section

Fig. 1.1 shows the entire configuration of the electronic section.

1.1.1. Filter PCB

The Filter PCB is on the AC primary side. It reduces noises which enter or are discharged through the power cord, and supplies AC voltage to the transformer.

1.1.2. Power Supply PCB

AC voltage, reduced by a transformer, is converted into three types of power: +VP (unstable), not to be used in this model, +12 V (stable), to be supplied to the control PCB and the CRT PCB, and +5 V (stable), to be supplied to the Control PCB. +5 V power is supplied to the FDD PCB through the Control PCB.

1.1.3. Control PCB

The Control PCB is the core of all functions described below and the CPU on this PCB controls all these functions.

1.1.4. Keyboard PCB (Material: FPC)

Electrodes are wired on a matrix and the CPU on the Control PCB controls the scan timing.

1.1.5. CRT unit

Display on CRT is done by the CRT unit and CRT control on the Control PCB controls the CRT unit.

1.1.6. FDD unit

The FDD unit reads and writes data recorded on a disk and supplies that data to the Control PCB.

This is controlled by the Main CPU via Gate Array and the FDC and FDD units.

1.2. Operational Outline of the Motors, Magnets and Switches

This section describes an operational outline of the motors, switches etc. shown in Fig. 1.1.

1.2.1. Wheel motor

The wheel motor, speed-reduced by gears (1:8), turns the daisy wheel clockwise and counterclockwise to select the characters. This is a ø 25, 24-step, PM-type step motor.

1.2.2. Carrier motor

The carrier motor drives the carrier. This is a ø 35, 48-step, PM-type step motor and is adjusted so as to move a pica-space distance in 12 steps (≈ 0.2117 mm/step) in 2-2 phase.

1.2.3. LF motor

The LF motor feeds paper. This is a ø 35, 24-step, PM-type step motor and is adjusted so as to feed paper in 32 steps (≈ 0.1323 mm/step) per line in 2-2 phase.

1.2.4. DC motor

DC motor drives the ribbon winder, strikes the hammer and carries out correcting operations.

1.2.5. Ribbon magnet

The ribbon magnet interlocks with the DC motor, hammer and ribbon feed drive cam. The magnet also functions as an impact control for the hammer.

1.2.6. Correction magnet

The correction magnet relocates the cam from the printing position to the correcting position to carry out correcting operations.

1.2.7. Carrier home-position switch

The carrier is brought to the home-position by an Out-of Control method that brings the carrier into mechanical contact with the chassis. A carrier home-position switch is installed on the carrier to detect that it is close to the home-position.

This switch is also adjusted so as to turn on when the ribbon is raised and operates as a countermeasure against the pop-up problem. The home-position is located immediately after turning the power switch to ON, after closing the cover or terminating correcting operations.

1.2.8. Cover switch

The cover switch registers if the cover is open or closed.

2. CONTROL PCB AND PERIPHERALS

2.1. Configuration

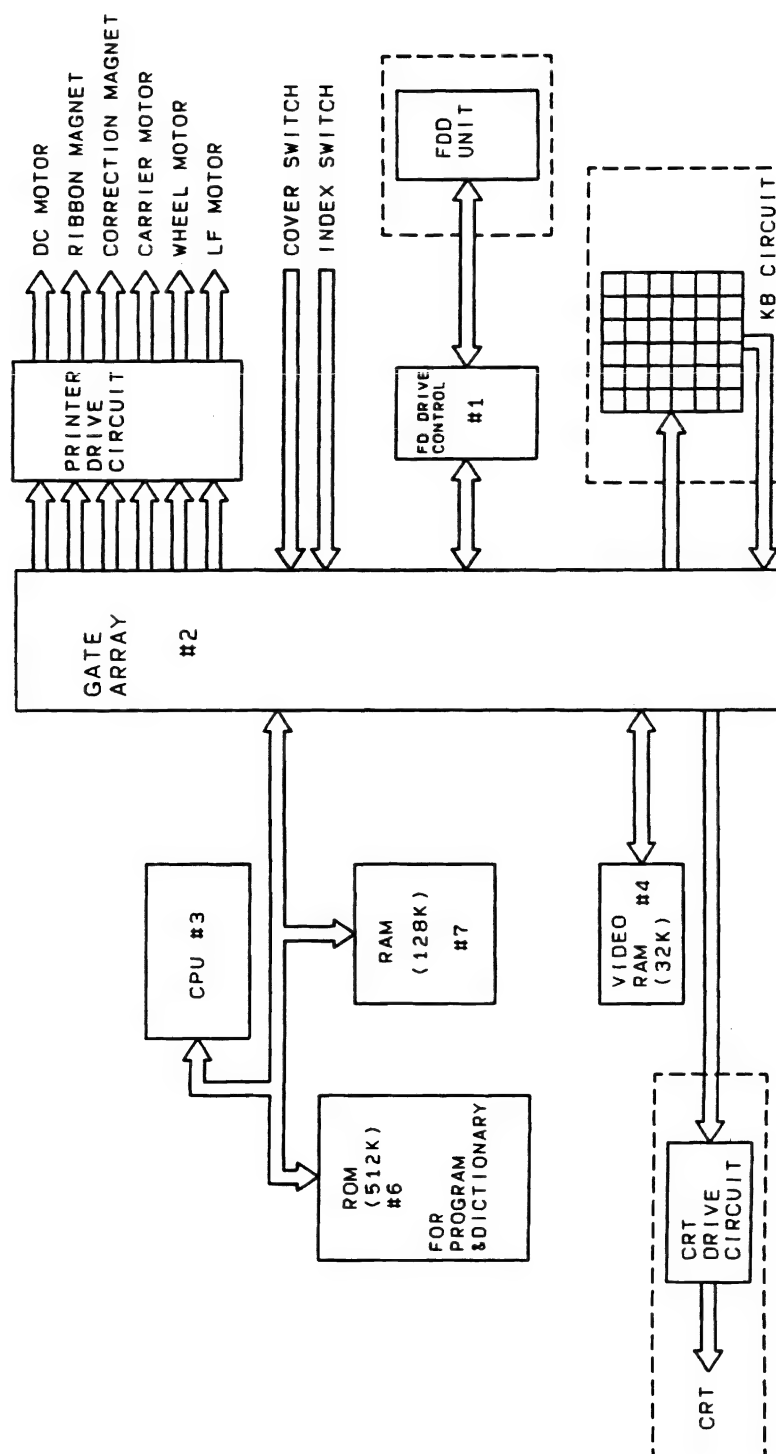


Fig. 2.1 Block Diagram of Control PCB

The Control PCB consists of a CPU, ROM, RAM, Gate array, Drive Circuit and Video RAM.

2.1.1. CPU (#3)

The CPU controls the entire system.

2.1.2. ROM (#6)

ROM stores the program to control the CPU and the data table for the spelling check.

2.1.3. RAM (#7)

A capacity of 128K-bytes is available as a CPU working area and text memory.

2.1.4. Gate array (#2)

This IC incorporates a circuit which generates a bus control signals on receiving a signal from the CPU, FDD control circuit, CRT control circuit and the key-scan circuit.

2.1.5. Drive circuit

The drive circuit converts the motor solenoid drive signals, output from the CPU and Gate Array 1, into +12 V drive signals and outputs them to each motor solenoid.

2.1.6. Video RAM (#4)

The CPU stores the display data here through the GA1 for the CRT display.

2.2. CPU Peripherals

2.2.1. Memory map

The CPU (HD64180) has a total of 19 address buses from A0 to A18 and a total 512K-byte memory. From this 512K-bytes, 64K-bytes of memory in three banks is selected for operation

The higher-order six bits (A13 to A18) are output to Gate Array 1 (#2) on the Control CPU, which carries out ROM/RAM memory enable control.

Addresses 40000 to 5FFFF are assigned for dictionary and bank program use with a memory of 128K-bytes which can be expanded 8 times with the installation of a hard bank (Port H) on the I/O map.

Fig. 2.2 shows the memory map.

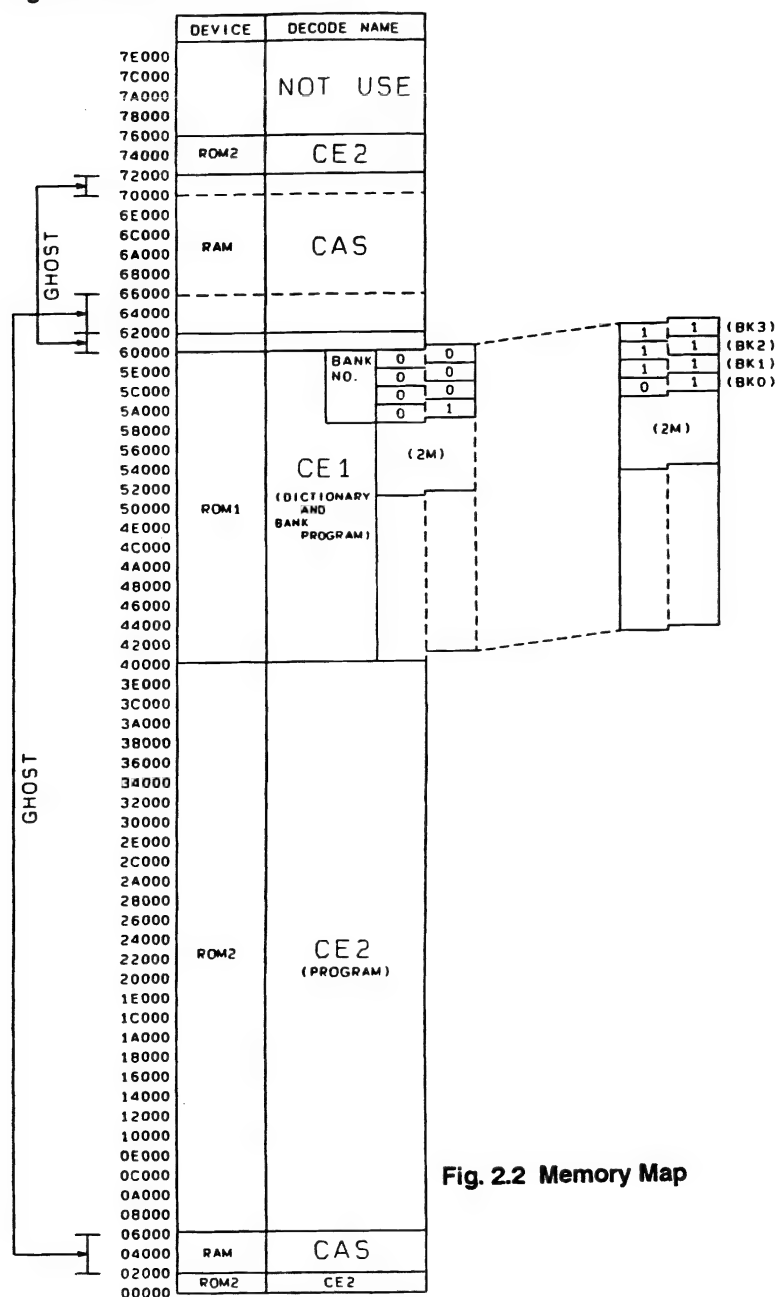


Fig. 2.2 Memory Map

2.2.2. I/O map

The CPU (HD64180) has 64K-bytes of I/O beside the 512K-byte memory. Addresses 0000H to 003FH are used as an internal CPU I/O. The following are used for external I/O:

- CRT control (inside Gate Array #2)
- FDD control circuit (FDC, HD63266 #1)
- Motor drive data latch circuit (inside Gate Array #2)
- Input data latch circuit (inside Gate Array #2)
- Key scan data latch circuit (inside Gate Array #2)
- Control data latch circuit for buzzer etc. (inside Gate Array #2)

The enable control of each of these is carried out by outputting lower-order address buses A0 to A7 from the CPU to Gate Array #2.

Fig. 2.3 shows the I/O map.

ITEM			DATA							
ADDR	PORT	I/O	7	6	5	4	3	2	1	0
70. 71	CRTC GATE ARRAY	O	V-RAM ADDRESS							
72		O	V-RAM WRITE DATA							
73		I	V-RAM READ DATA							
74		O	CURSOR DISP	CURSOR BLINK	CURSOR SIZE		V-RAM ADDRESS AUTO INCREMENT		DISP ON, OFF	REVERSE
75. 76		O	CURSOR ADDRESS							
77			NOT USE							
78-7F	FDC	I/O	FDD CONTROL							
A8	PB	I	0	0	0	0	1	CA-INDEX	1	COVER
B0	PC	I	1	1	S5	S4	S3	S2	S1	S0
B8	KB	I	K17	K16	K15	K14	K13	K12	K11	K10
		O					(KX3)	(KX2)	(KX1)	(KX0)
C0	PD	O					CA-A	CA-B	CA-C	CA-D
C8	PE	O					WH-A	WH-B	WH-C	WH-D
D0	PF	O					LF-A	LF-B	LF-C	LF-D
D8	PG	O				(NOUSE)		CO-SOL	RB-SOL	DC-M
E0	PH	O					(BK3)	(BK2)	(BK1)	(BK0)
E8	PJ	O								
F0	PK	O							(PORT)	BUZZER
F8	INT	O	1mS-TIMMER INTERRUPT REQUEST CLEAR							

Note:() shows the inside resistor.

Fig. 2.3 I/O Map

2.2.3. Clock circuit

Two different clock circuits are incorporated on the Control PCB. Fig. 2.4 shows the differences.

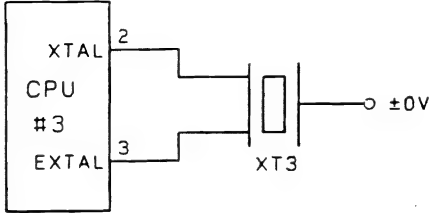
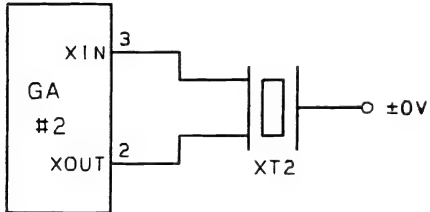
Clock Circuit	Frequency	Usage
	12.288 MHz	CPU oscillation clock. Cpu operates according to clock XT3.
	15.33 MHz	XT2 is the CRT dot clock frequency generating clock frequency generating clock. GA1 operates the inside CRT control circuits and VIDEO RAM according to this clock.

Fig. 2.4 Clock Circuits

2.2.4. Reset circuit

Fig. 2.5 shows the reset circuit.

This circuit resets the CPU, GA and FDC. When the power switch is turned to ON or Off. When the power switch is turned ON, +5 V power immediately rises, but +12 V power does not immediately rise. Until +12 V power reaches about +9 V, the transistor Q4 is off and Q3 is on. Therefore, "L" signal is supplied to CPU, GA and FDC, and remains reset station. When +12 V power goes up over +9 V, the transistor Q4 is on and Q3 is off and "H" signal is supplied to CPU, GA and FDC. This "H" signal makes the CPU, GA and FDC active. When the power switch is turned OFF, the CPU, GA and FDC become inactive in the reverse steps.

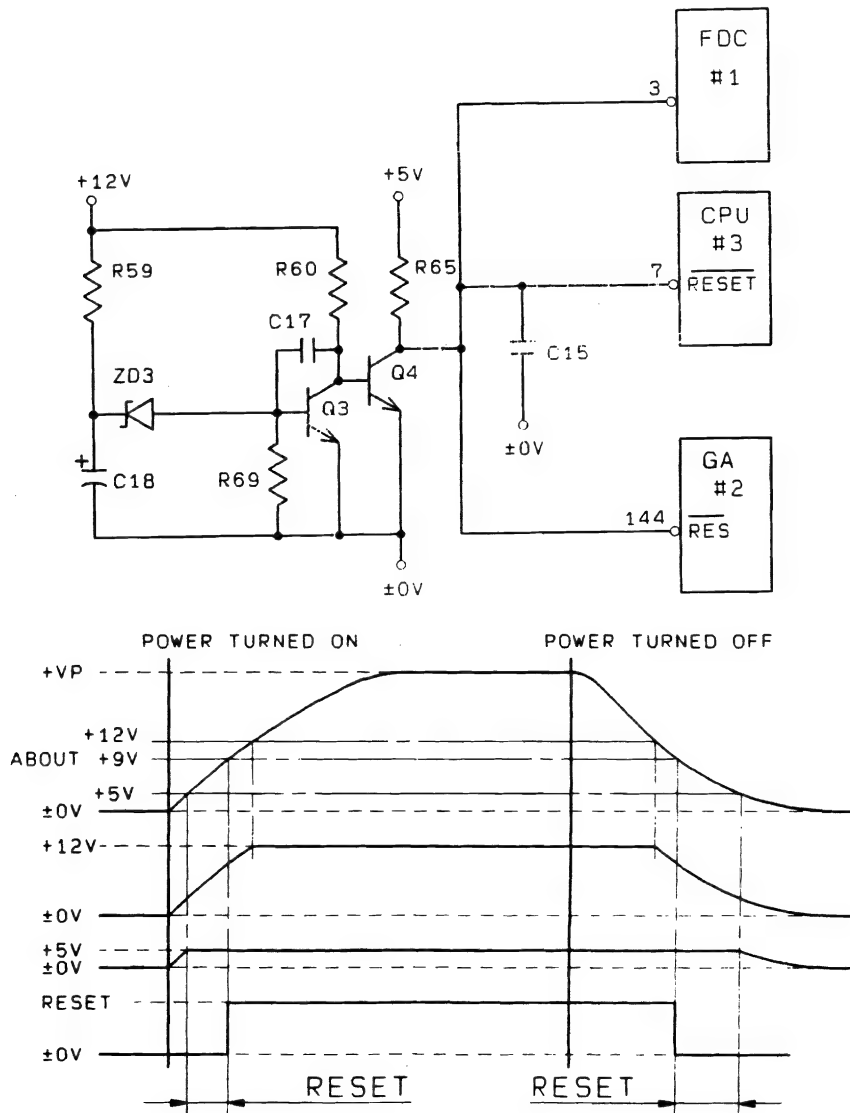


Fig. 2.5 Reset Circuit

2.2.5. Specification change-over

Fig. 2.6 shows the circuit to change over for specifications. Pull-up resistors are incorporated in terminals PC0 to PC5 of Gate Array 1 #2. The specification is recognizable by the solder on the solder points.

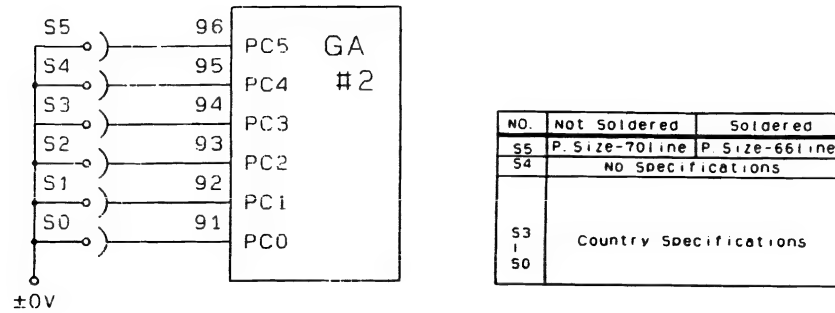


Fig. 2.6 Circuit to Change Over for Country Specifications

2.2.6. Buzzer drive circuit

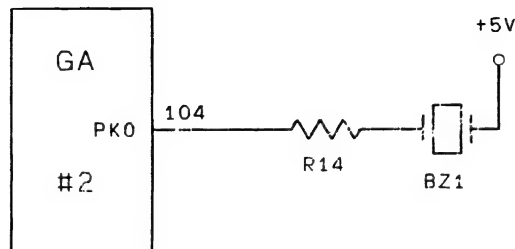


Fig. 2.7 Buzzer Drive Circuit

Fig. 2.7 shows the buzzer drive circuit.

When buzzer operation is needed a 4K Hz pulse of 50% duty is output from Port PK0 (Pin 104) of Gate Array #2. The piezoelectric element in BZ1 generates sound through this pulse. The output from Port PK0 is HIGH when the buzzer is not in operation.

2.2.7. ROM configuration mode change-over

JW133 and JW158 are used to change address bus configuration according to ROM configuration.

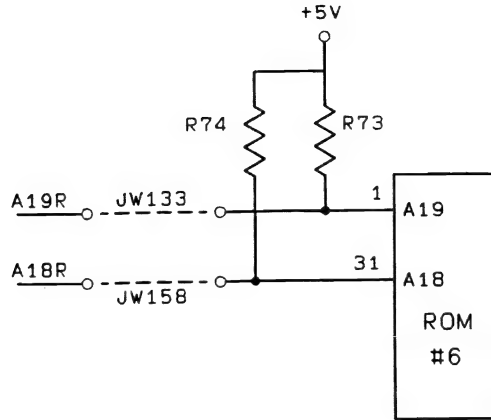


Fig. 2.8 Circuit for Changing ROM

ROM TYPE	PIN1	PIN31	JW133	JW158
2M PROM	VPP	$\overline{\text{PGM}}$	X	X
2M MASK ROM	NC	D. C	X	X
4M PROM	VPP	A18	X	○
4M MASK ROM	D. C	A18	X	○
8M MASK ROM	A19	A18	○	○

○ . . . ASSEMBLE

X . . . NOT ASSEMBLE

2.3. Control of the Motors, Magnets and Switches

2.3.1. Wheel motor control

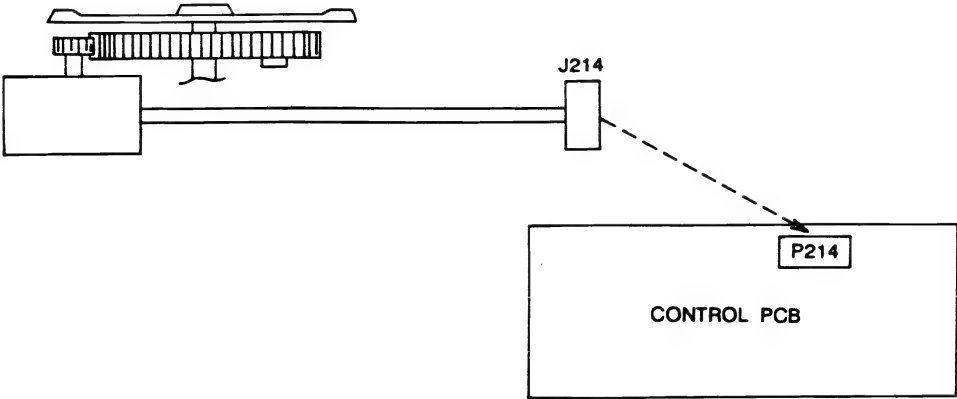


Fig. 2.9 Configuration of the Wheel Motor Unit

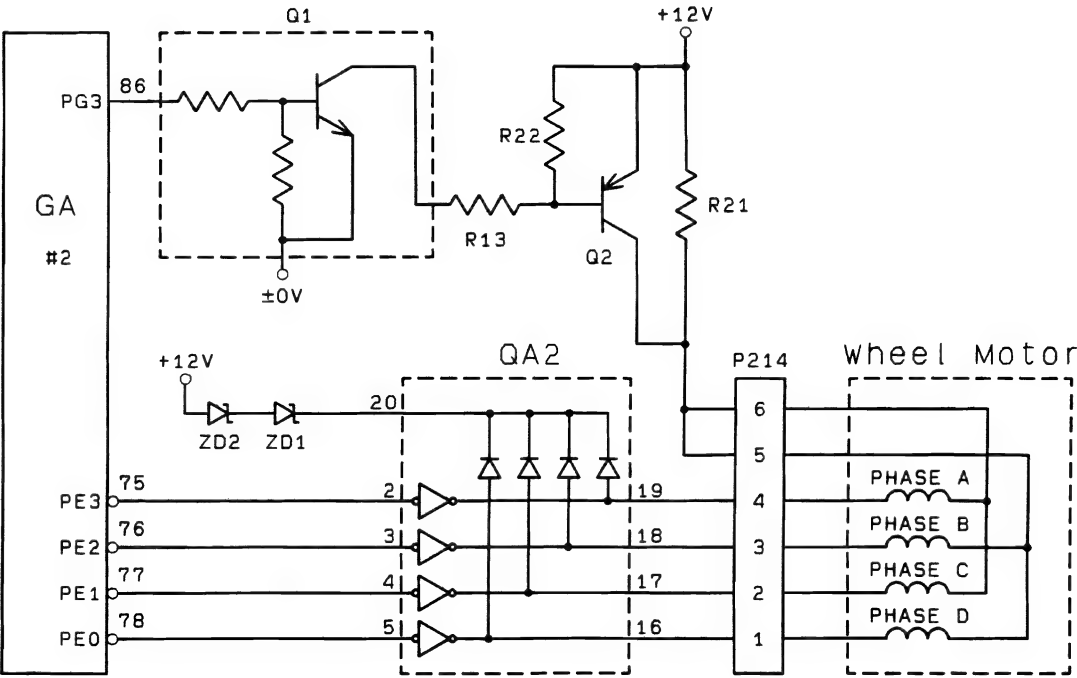


Fig. 2.10 Wheel Motor Drive Circuit

Fig. 2.9 shows the configuration of the wheel motor unit and Fig. 2.10 shows the wheel motor drive circuit. The unit, using a 4-phase motor (phase A, phase B, phase C, and phase D), is controlled by the CPU #3 through Gate Array #2, and Transistor Array QA2 which incorporates 8 transistors. CPU #3 controls the supplement voltage which uses pulse output and weak output through the GA #2, Q2, and Q1. When the port PG3 of GA #2 goes to "H", +12 V is supplied to the excited phase. When wheel selection is required due to a key input, the CPU outputs to the wheel motor the following three different controls:

(1) Weak excitation

The purpose is to hold the motor at stop in the current phase. The motor is always slightly excited except when being driven.

(2) Pulse output

The pulse output control results in a pulse output in the order of Phases AB-Phases BC-Phases CD-Phases DA or in the reverse order. To drive the motor, 1-2 phases are excited when selecting one or two characters, and 2-2 phases are excited when selecting three or more characters. To drive one spoke of the daisywheel, pulses are output in four steps for 1-2 phases and in two steps for 2-2 phases.

(3) Damping stop (22 msec)

After outputting pulses, some power voltage is supplied for stabilization after the phases have stopped electrically; otherwise the motor shaft and daisy wheel would remain unsteady or so-called damping would occur.

During hammer operations, weak excitation stabilizes daisy wheel detent. +12 V is used as a drive voltage. Fig. 2.11 shows a time chart of wheel motor operations driven in 12 steps.

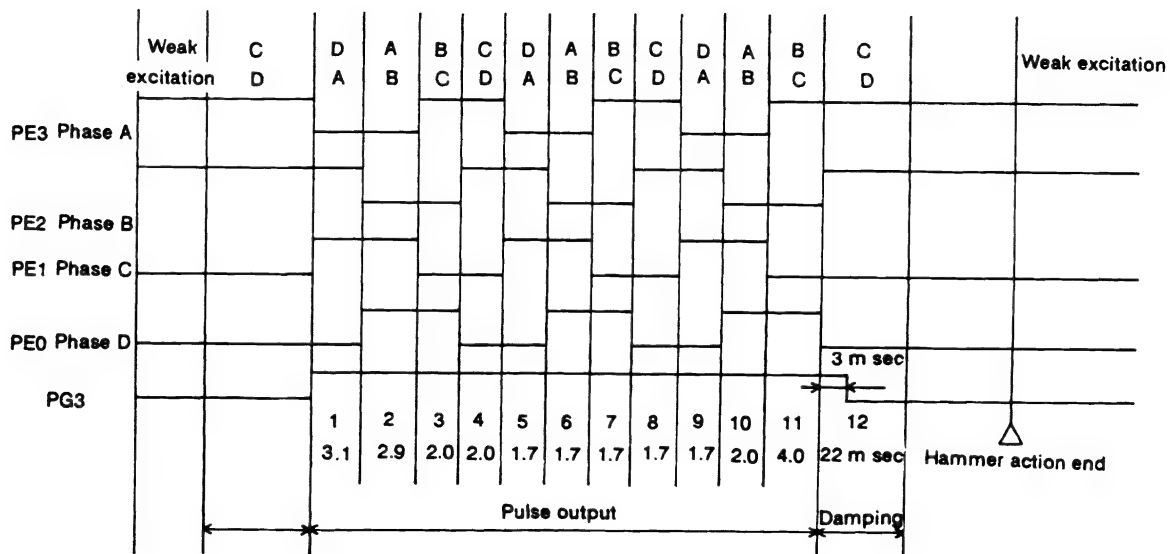


Fig. 2.11 Time Chart of Wheel Motor Operation

2.3.2. DC motor control

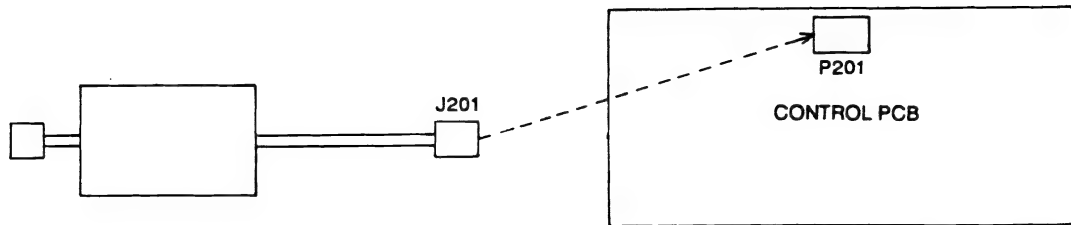


Fig. 2.12 Configuration of DC Motor Unit

Fig. 2.12 shows the configuration of the DC motor unit. The DC motor is the driving power source to wind the ink ribbon and carry out correcting operations and hammer operations. In the typewriter stand-by status the motor is stopped, and starts on input from the keyboard, reaching a constant running speed after idling for about 60 msec. The clutch is then engaged to interlock with the driving parts for various operations. Once interlocked, the clutch is stopped by a stopper after one revolution and then disengaged.

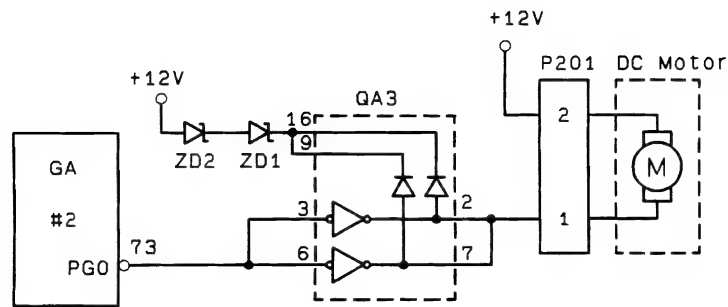


Fig. 2.13 DC Motor Drive Circuit

Fig. 2.13 shows the DC motor drive circuit. A +12 V DC motor is used here and is controlled by the CPU #3, Gate Array #2 and Transistor Array QA3. The drive voltage is +12 V and the Port PGO goes to HIGH level during motor activation.

2.3.3. Ribbon magnet control

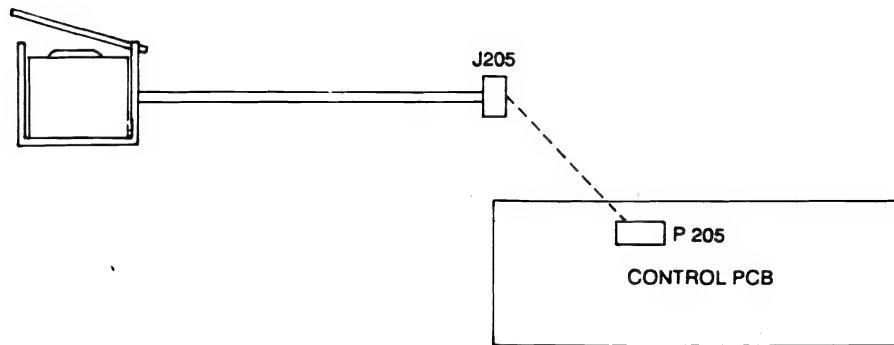


Fig. 2.14 Configuration of Ribbon Magnet Unit

Fig. 2.14 shows the configuration of the ribbon magnet unit. The ribbon magnet functions as a trigger for the clutch; interlocking the DC motor and the ribbon cam. It also functions as a controller of hammer impact control which is operated in two stages, light impact printing will result when the magnet is excited.

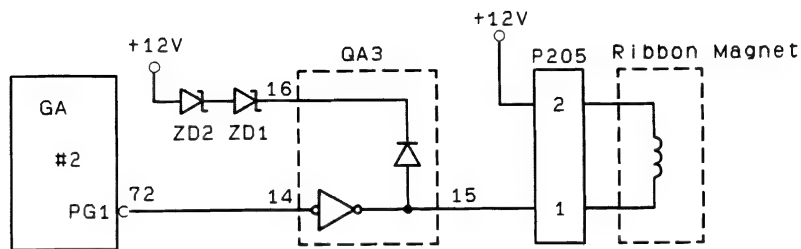


Fig. 2.15 Ribbon Magnet Drive Circuit

Fig. 2.15 shows the ribbon magnet drive circuit. When Port PG1 goes LOW, the magnet is energized; this occurs when starting printing operations (ribbon winding and hammer striking) and carrying out impact control. ZD1 and ZD2, Zener diodes, absorb surges when the magnet is de-energized to protect drive element and improve disappearance of the magnetic flux. Fig. 2.18 shows the drive time chart.

2.3.4. Correction magnet control

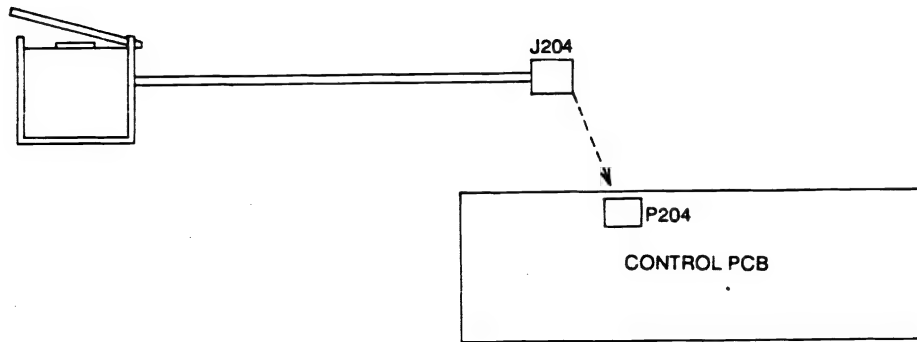


Fig. 2.16 Configuration of Correction Magnet Unit

Fig. 2.16 shows the configuration of the correction magnet. The correction magnet functions as a trigger for the clutch interlocked with the DC motor. The correcting operations consist of four strokes of the hammer.

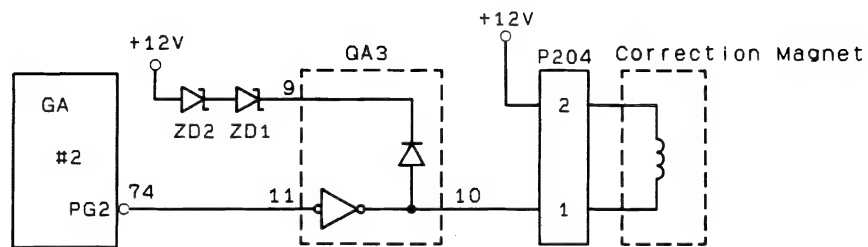
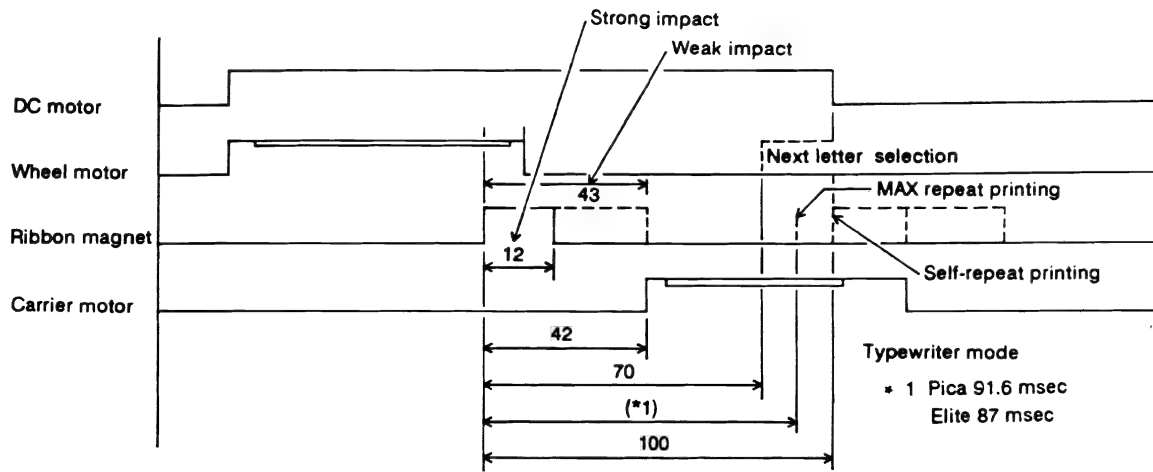


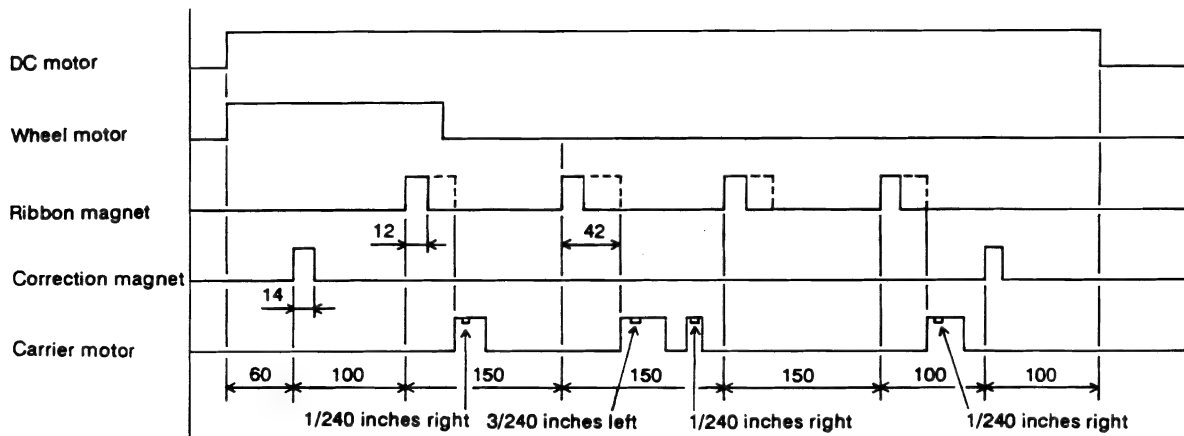
Fig. 2.17 Correction Magnet Drive Circuit

Fig. 2.17 shows the correction magnet drive circuit. When Port PG2 goes LOW, the magnet is energized. The magnet is activated twice: to lift the correction tape and to lower the tape. The first drive changes over the cam track to the correction side and, after the four strokes of the hammer, the second drive changes over the cam track from the correction side to the printing side. Fig. 2.18 shows the drive time chart.

a) Printing process



b) Correcting process



c) Bold printing process

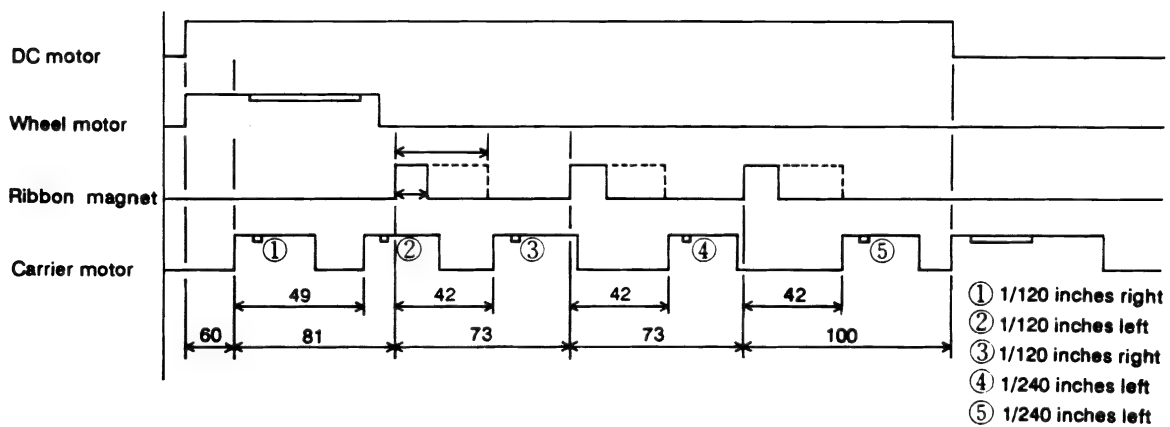


Fig. 2.18 Drive Time Chart of DC Motor Peripherals

2.3.5. DC motor peripheral control

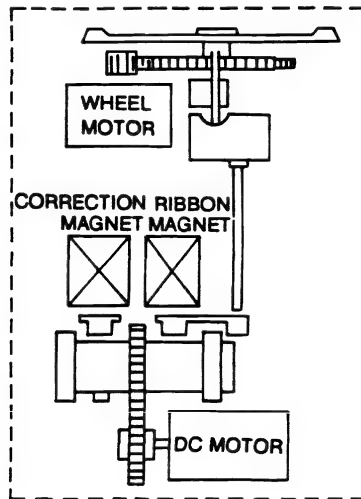


Fig. 2.19 Configuration of DC Motor Peripherals

Fig. 2.19 shows the configuration of the DC motor peripherals. All mechanisms illustrated above operate in connection with the DC motor.

The DC motor is the driving power source for ribbon operations (including hammer impact control) and correcting operations.

2.3.6. Carrier motor control

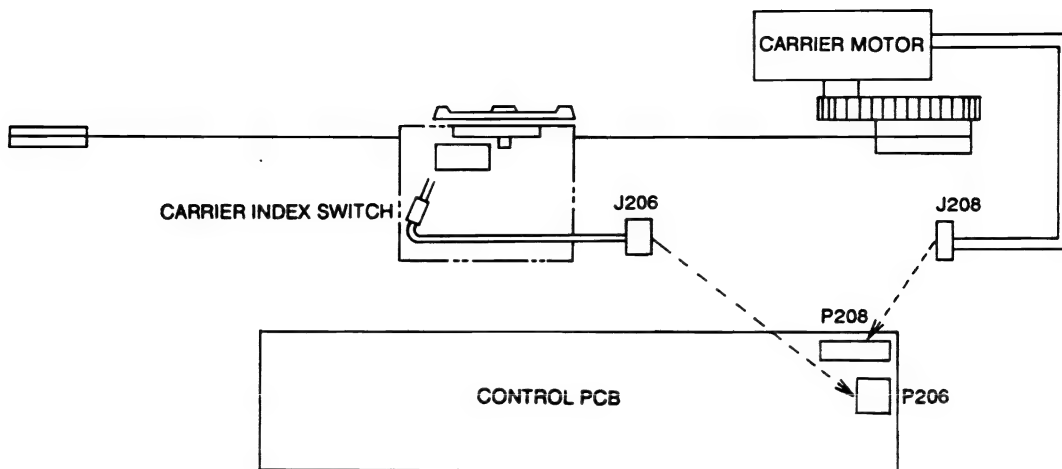


Fig. 2.20 Configuration of Carrier Motor Unit

Fig. 2.20 shows the configuration of the carrier motor. The carrier motor is a step motor. When the power is switched on, the motor drives the carrier to the left until the carrier index is detected. The index switch acts as the datum to determine the position of the first character to be printed. The smallest increment of movement the carrier can make is 1/120 inch.

The number of drive pulses for each pitch are as below:

Pitch	No. of pulses	Paper feed increment
Pica	12	1/10 inch
Elite	10	1/12 inch

Both pitches are driven by 2-2 phase excitation.

Fig. 2.21 shows the carrier motor drive circuit. The excitation phases of the step motor (A, B, C and D) are controlled by Ports PD3, PD2, PD1 and PD0 on Gate Array #2 and driven by Transistor Array QA1 incorporating the four circuits.

The carrier motor, driven by +12 voltage power, is controlled in the modes of pre-excitation, pulse output and damping stabilization control. When the motor is stopped or not in operation, all phases (A, B, C and D) are in the OFF state, or in the so-called no-excitation state.

Fig. 2.22 shows an example of carrier motor operations.

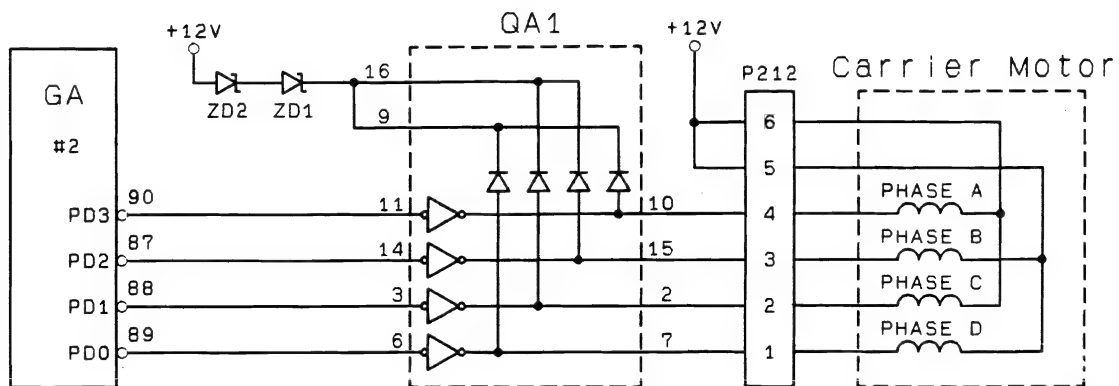


Fig. 2.21 Carrier Motor Drive Circuit

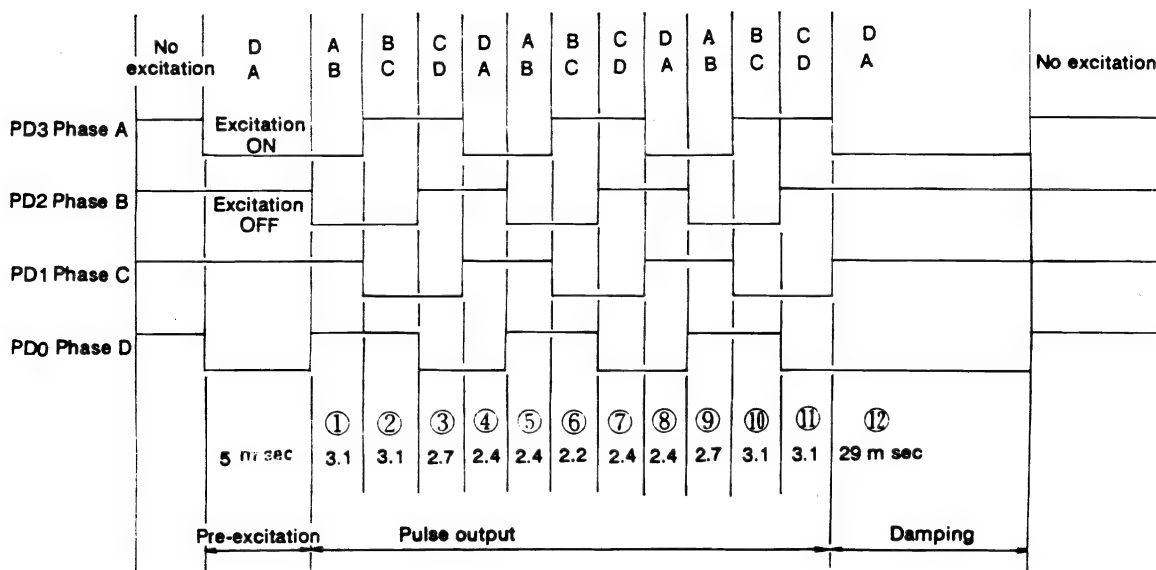


Fig. 2.22 Example of Carrier Motor Action

2.3.7. LF motor control

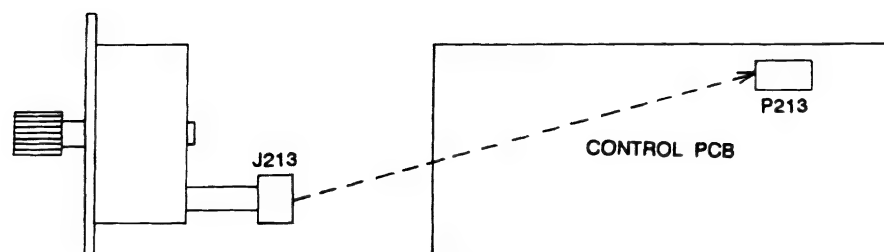


Fig. 2.23 Configuration of LF Motor Unit

The LF motor is driven in 2-2 phase excitation by a single +12 V power supply for every operation. The motor is controlled so as to turn in 2-2 phase and 32 steps for each line-spacing setting at 1/6 inch pitch. The line spacings available through the LF selector key or input from the keyboard are as below:

LF pitch selector	Feed pitch	No. of drive pulses	Paper feed speed	
1	1/6 inch	32	107.3 msec	*
1 1/2	1/4 inch	48	160.1 msec	*
2	1/3 inch	64	219.5 msec	*

* Damping stabilization time is not included.

Fig. 2.24 shows the LF motor drive circuit. The excitation phases of the step motor (A, B, C and D) are controlled by Ports PF3, PF2, PF1 and PF0 on Gate Array #2 and driven by Transistor Array QA2 incorporating the 8 circuits.

The LF motor is controlled in the modes of pre-excitation, pulse output and damping stabilization and the waiting time during pulse output is always 75.8 msec. When the motor is stopped or not in operation, all phases (A, B, C and D) are in the no-excitation state.

Fig. 2.25 shows an example of 1/6 inch paper feed operations.

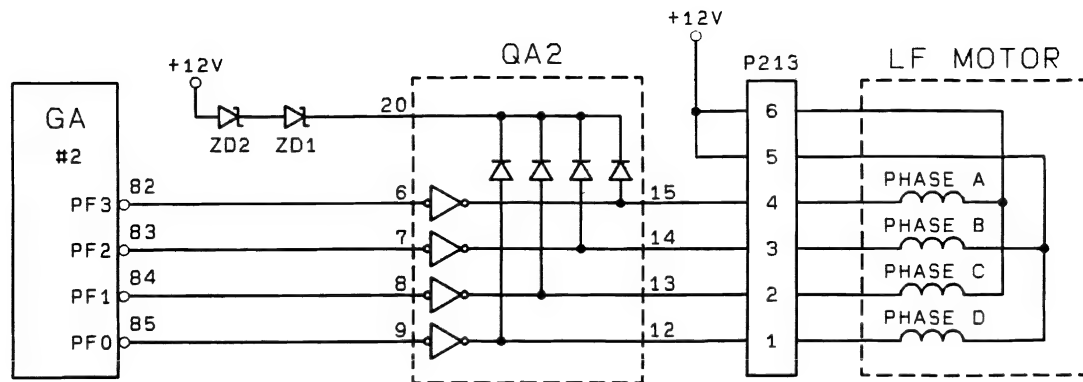


Fig. 2.24 LF Motor Drive Circuit

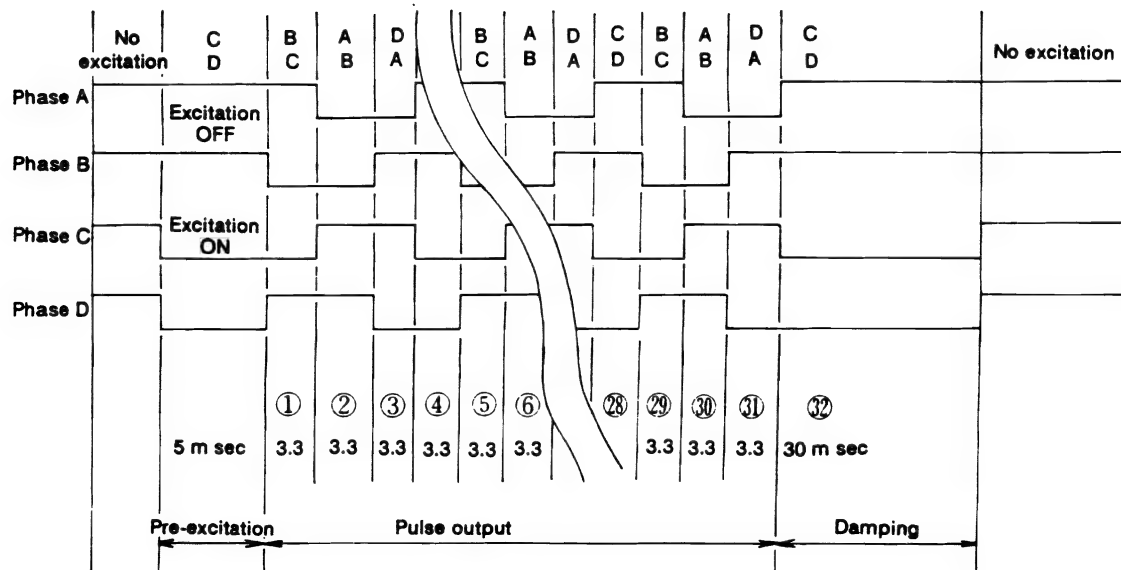


Fig. 2.25 An Example of LF Motor Action

2.3.8. Carrier index switch and cover switch

The configuration of the carrier index switch unit shown in Fig. 2.20 (configuration of the carrier motor switch). The switch, located at the left of the chassis, is arranged so as to turn on at the 6th step or before the 33rd step of the 2-2 phase excitation of the carrier motor; it is basically free of adjustment.

To prevent the ribbon pop-up phenomenon, the carrier index switch is arranged so as to turn on when the ribbon is lifted during correcting operations. A check is made by the CPU to detect if the index switch is on when the power is switched on, when the cover is closed or when correcting operations are completed. The DC motor and the correction magnet will then be activated so as to lower the ribbon.

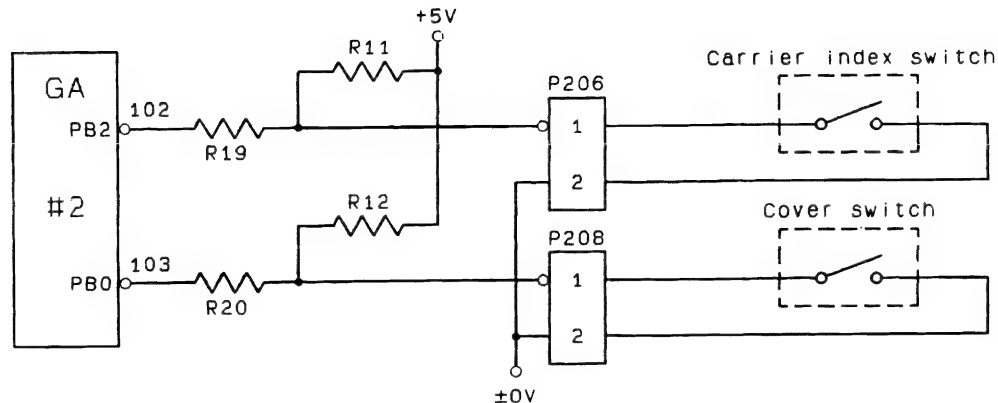


Fig. 2.26 Switch Input Circuit

When the carrier index switch is open, the "H" signal is input to PB2 of Gate Array #2, and when it is closed, the "L" signal is input to PB2.

The cover switch is mounted on the top cover. This switch is provided to keep the machine inoperative while the top cover is open; with this if a key is touched mistakenly while a users is changing the wheel, for example, key touch is ignored.

The "H" signal is input to port PB0 of Gate Array #2 when the cover is open and the "L" signal is input when the cover is closed. The "Cover Open" message is displayed on the CRT while the cover is open.

These input signals are transmitted to the CPU #3 through the Gate Array #2 and the CPU #3 controls machine operation according to the input signal.

2.3.9. Home position recovery systems

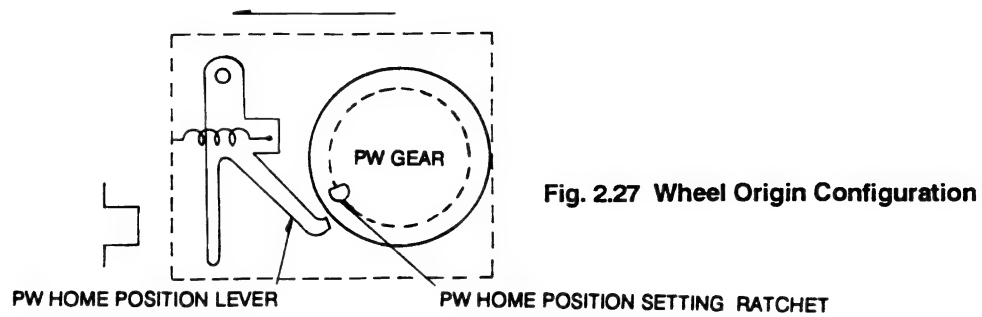


Fig. 2.27 Wheel Origin Configuration

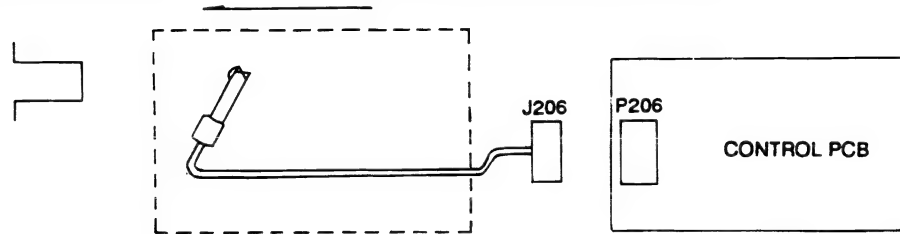
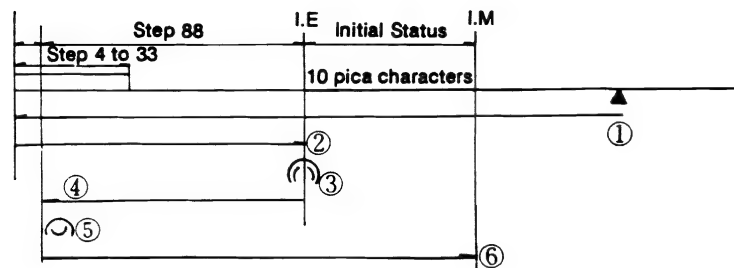


Fig. 2.28 Configuration of Carrier Home Position



- (1) To start at a position except for the far left
 - a) 150 msec after the DC motor is turned on, the carrier moves left (the ON state is confirmed by a sensor in eight consecutive scanning cycles).
 - b) The carrier moves 39 steps to the right.
 - c) The daisy wheel rotates twice (a daisy wheel pin is set).
 - d) The carrier moves 38 steps to the left.
 - e) The daisy wheel rotates once (the daisy wheel home position is at ",").
The daisy wheel rotates 12 segments in the reverse direction (the daisy wheel stops at the letter "h" position).
The LF backlash is corrected (by moving the LF up and down for 16 steps in both directions).
 - f) The carrier moves to the left margin (LM).
- (2) To start at the far left
 - a) 150 msec after the DC motor is turned on, the carrier moves right 40 steps.
 - b) The carrier moves left (the ON state is confirmed by a sensor in eight consecutive scanning cycles).
 - c) Operations b) to f) of (1) will follow.

2.4. Keyboard PCB

2.4.1. Keyboard configuration

Fig. 2.32 shows the keyboard configuration.

The keyboard is a flexible printed circuit (FPC) board on which the circuit pattern and electrodes are printed. When a key is pressed down, the key stem is forced down until carbon-type conductive silicon rubber makes contact with the FPC electrode and electricity is conducted.

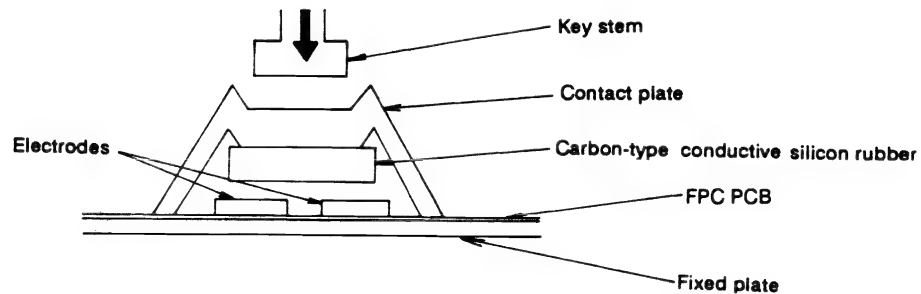


Fig. 2.29 Keyboard Configuration

2.4.2. Keyboard scan

As Fig. 2.30 shows, the electrodes on the board are wired on the matrix (the figure below shows only simplified wiring for ease of explanation and is slightly different from the actual wiring).

Utilizing Fig. 2.30, the outline of keyboard scanning operations is described below. When a key is not pressed, continuity does not exist in any combination on the matrix, such as X1 and Y1 or X1 and Y2. For example, if Key (A) is pressed, continuity will exist only in X2 and Y3 and the others are left in the OFF status. In other words, if continuity exists between X2 and Y3, it means that Key (A) is being pressed.

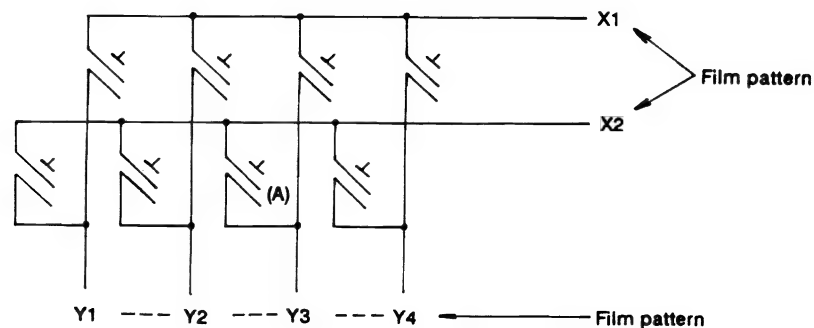


Fig. 2.30 Electrode Wiring

2.4.3. Keyboard control circuit

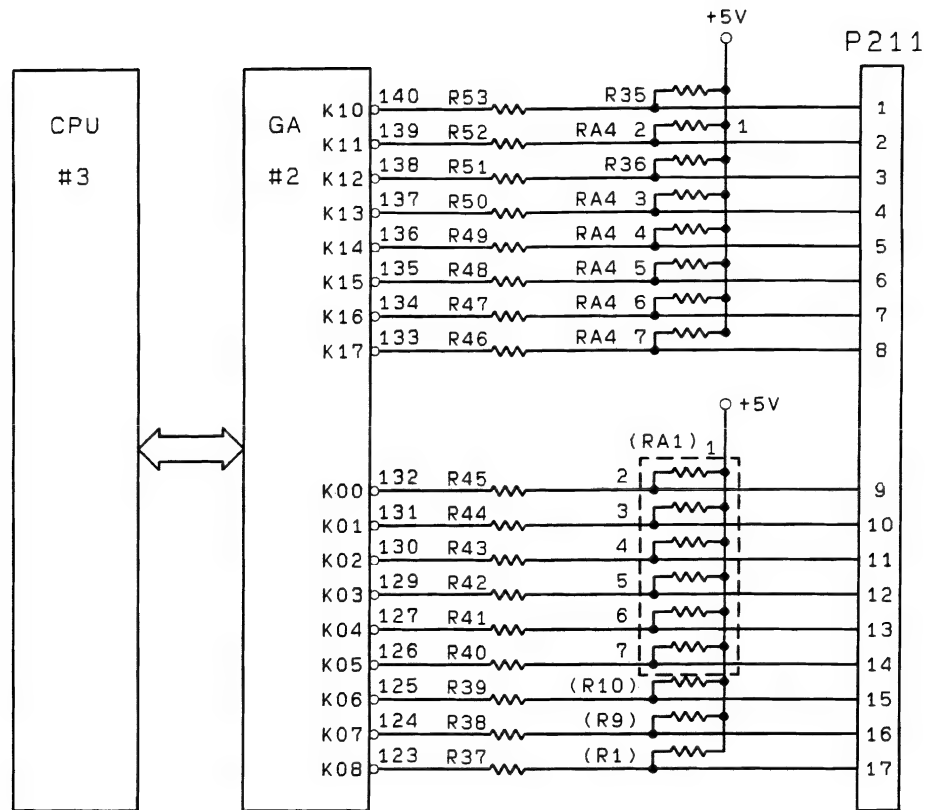


Fig. 2.31 Keyboard Control Circuit

The keyboard control circuit is shown in Fig. 2.31.

The matrix pattern on the keyboard PCB controls Gate Array #2 according to data signals D0 through D3 of the CPU #3. The LOW level signal is output to output lines KO0 through KO8. The electrode wiring is scanned line by line beginning with Y0. If a key has been pressed, the electrode wirings X0 through X7 that correspond to the pressed key become LOW, the result of scanning is input to KI0 through KI7 of Gate Array #2. CPU #3 detects which key has been pressed. The key matrix given shown in Fig. 2.32 corresponds to the key arrangement shown in Fig. 2.33.

		Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8
		9	10	11	12	13	14	15	16	17
X0	1	F4	F14	F5	F10	F6		F8	F11	
X1	2	A38	A36	A27	A34	A25	A39	A23	F17	F12
X2	3	AA5	A37	A35	A26	A33	AA6	A24	F18	F13
X3	4						AA4		F16	F15
X4	5	A21	A19	A28	A17	A15	A30	A32	F7	AA1
X5	6	A10	A29	A7	A6	A3	A31	A2	F3	AA3
X6	7	A11	A9	A8	A5	A4	A12	A1	F1	F2
X7	8	A22	A20	A18	A16	A14	A0	A13	F9	AA2

Fig. 2.32 Keyboard Matrix

A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	F1	F2	F3	F4	F5	
F6		A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	AA1	AA2	F7				
F8		A23	A24	A25	A26	A27	A28	A29	A30	A31	AA3	AA4	A0	F9	F10			
F11		A32	A33	A34	A35	A36	A37	A38	AA5	A39	AA6	F11		F12			F13	F14
F15		F16								F17		F18						

Fig. 2.33 Keyboard Arrangement

3. CRT UNIT

The CRT unit consists of two major circuits - one of these circuits generates logic level display and retrace line signals on the control PCB, and the other circuit raises logic level voltage to the voltage level necessary to display dots on the CRT connected to the CRT PCB.

3.1. Logic Level Signal Generation Circuit

3.1.1. Outline

The block diagram of the logic level signal generation circuit is shown in Fig. 3.1.

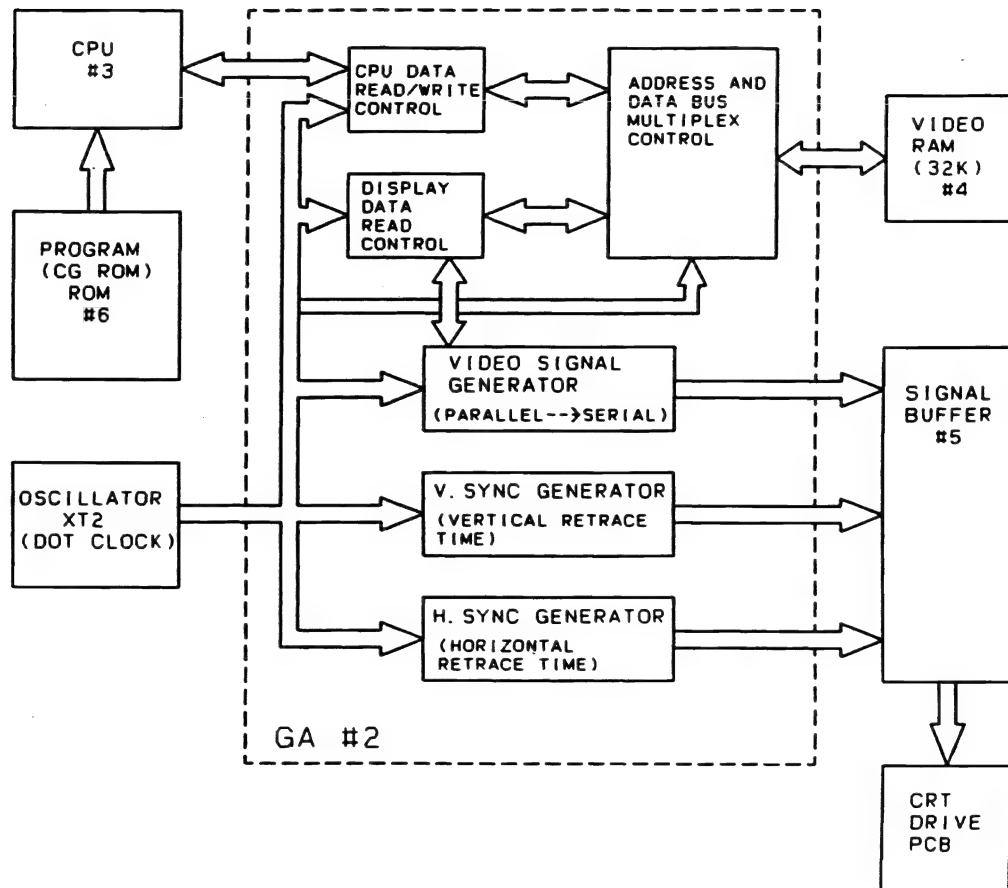


Fig. 3.1 Block Diagram of CRT UNIT

(1) Gate Array #2 (CRTC)

This is the core of the CRT control section. This IC incorporates the circuit that receives the display data from the CPU #3 and stores it in VIDEO RAM #4, the video signal generation circuit that converts the parallel display data, read from VIDEO RAM #4, into the serial display data, and the H.SYNC and V.SYNC generation circuits that generate the signals to control electron beam on the CRT.

(2) CPU #3

This CPU determines the contents to be displayed on the CRT and stores them to VIDEO RAM #4 through Gate Array #2. The data stores here is the graphics data that turns on and off the dots on the CRT. For the display of a character, the CPU #3 reads the character font data, stored in PROGRAM ROM #6, according to the character code and stores the read font data to VIDEO RAM #4 through Gate Array #2.

(3) VIDEO RAM #4 (32 KB RAM)

The data to be displayed on the CRT is stored in graphics form dot data.

(4) PROGRAM ROM #6

This ROM stores the font data table using the character code as the key in addition to the program.

(5) Oscillator XT2

The oscillator generates reference clock to control the CPU operation timing for the CRT control. Its frequency is 15.33 MHz, that exactly corresponds to the speed required to display one (1) dot on the CRT.

(6) Signal Buffer #5

The signals sent from the Gate Array #2 are buffered and then sent to the CRT unit.

3.1.2. Relationship between VIDEO RAM and Screen Display

The relationship between the VIDEO RAM address and the display position on the CRT, and font configuration of normal characters stored in PROGRAM ROM #6 are shown in Fig. 3.3.

One (1) dot on the CRT corresponds to one (1) bit of VIDEO RAM #4. If "1" is stored at bit 0 of address 5A in VIDEO RAM #4, a yellow dot at the upper right corner is displayed.

Normal characters are configured in "8 bits x 16 rasters". This area includes a space between characters. To change a single character, the CPU sends data 16 times to VIDEO RAM #4. The VIDEO RAM #4 is arranged on the I/O map of CPU #3 and is not arranged in the memory map. The CPU #3 controls the contents of VIDEO RAM using the I/O address (70H to 77H).

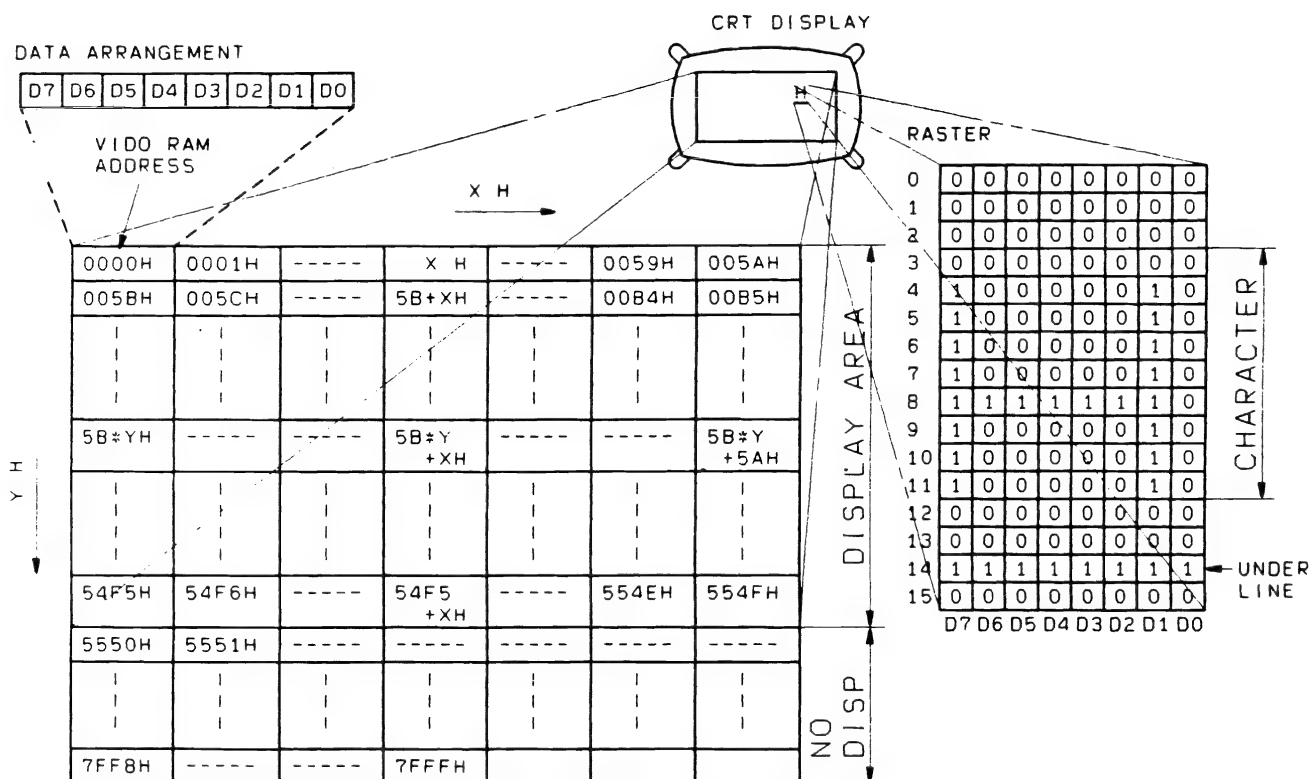


Fig. 3.3 Configuration of VIDEO RAM and Character

3.1.3. VIDEO RAM #4 Access

The VIDEO RAM #4, connected only to the Gate Array #2, has the data update mode in which the character font data is updated and the data read mode in which the data to be displayed on the CRT is read. The time* used to display 8 dots on the CRT is split into two and the former portion is used for access for display and the latter portion for access for data update.

* $520 \text{ ns} = 1/15.33 \text{ MHz} \times 8$

The timing chart is shown below.

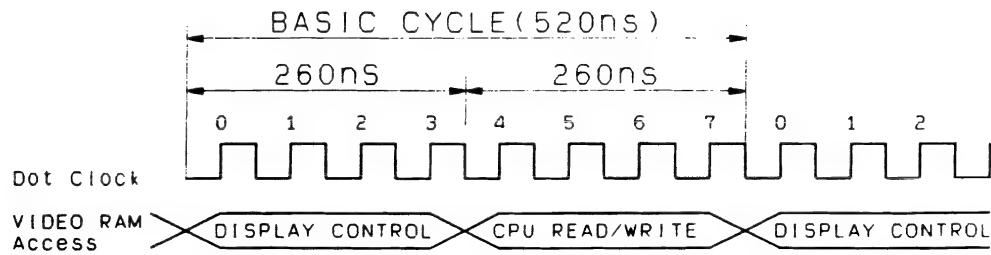


Fig. 3.4 Video RAM Access

3.1.4. CRT display timing chart

To display a character on the CRT, video signal in which the data to be displayed is arranged serially and the H.SYNC and V.SYNC signals used to synchronize display timing with the CRT are necessary.

The contents of video signals change according to the contents of display. However, the H.SYNC and V.SYNC signals are the signals for synchronization and, therefore, they are output at the same timing.

The H.SYNC signals are horizontal synchronization signals and the V.SYNC signals are vertical synchronization signals.

The CRT display timing chart is shown in Fig. 3.5.

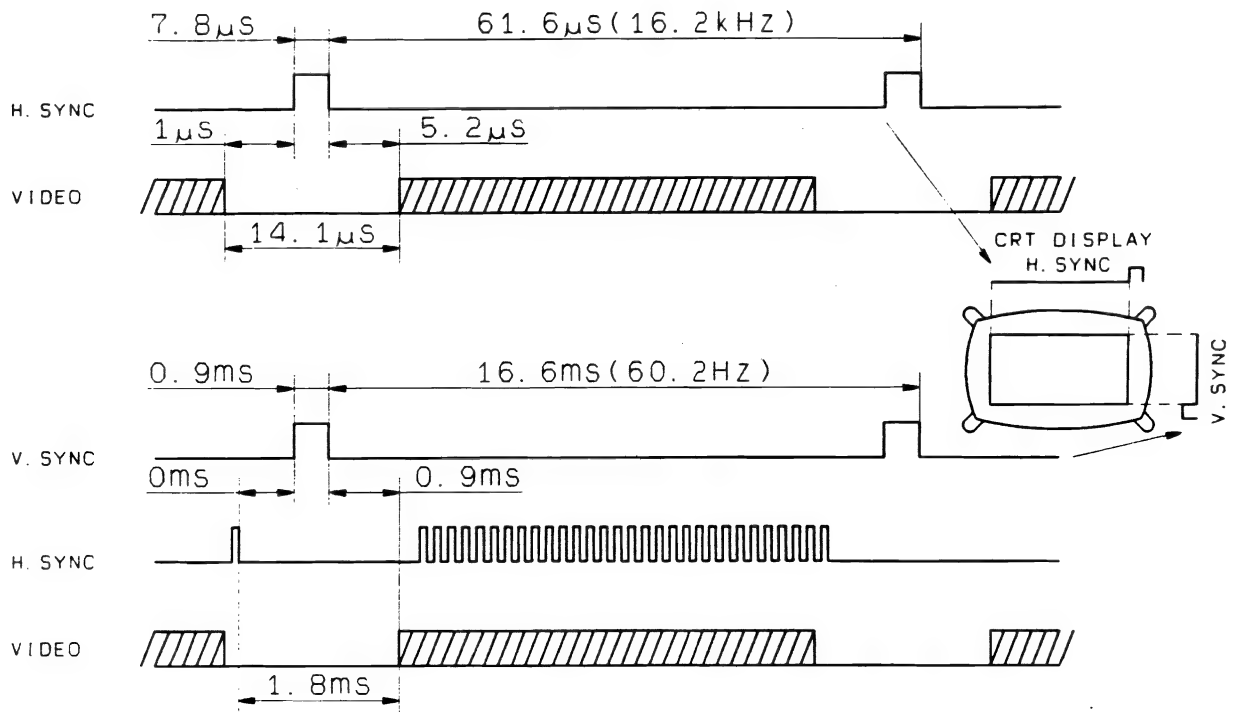


Fig. 3.5 CRT Timing Chart

3.2. CRT Drive

3.2.1. Theory of CRT display operations

Display signals (VIDEO) and synchronization signals (H.SYNC and V.SYNC), generated on the Control PCB are converted to signals to drive electrons on the CRT Drive PCB.

VIDEO signals are converted into new voltages by the CRT Drive PCB and then supplied to the CRT cathode. Heated by heater (H), thermions are then discharged from the cathode. Grid 1 (G1) controls the thermionic flow rate by means of a voltage lower than that of the cathode. Electrons which have passed through Grid are accelerated by a positive charge on Grid 2 (G2) and Grid 4 (G4) and reach the fluorescent screen. The phosphor on the screen fluoresce and dots are displayed.

H.SYNC signals are converted on the CRT PCB into a 16.2 KHz sawtooth wave which drives a horizontal deflection coil. The electron beam is moved sideways by the magnetic field of this horizontal deflection coil.

V.SYNC signals are converted on the CRT PCB into a 60.2 Hz sawtooth wave which drives a vertical deflection coil. The electron beam is moved laterally by the magnetic field of the vertical deflection coil.

The CRT display is operated through these processes.

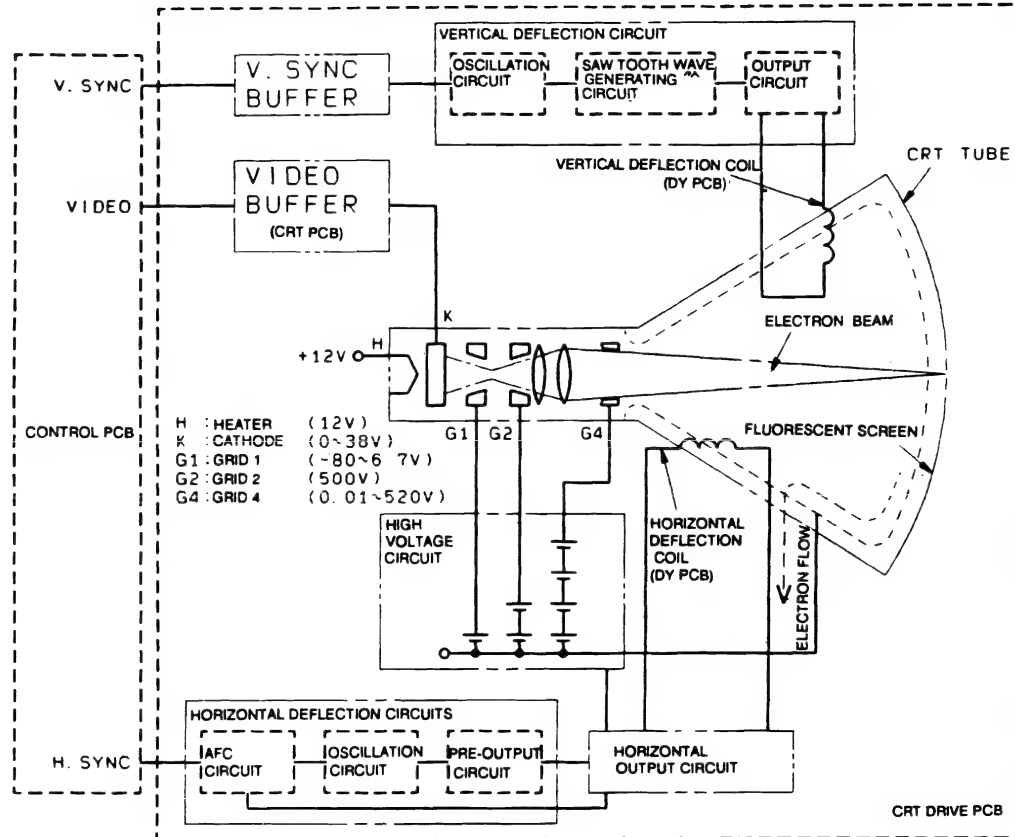


Fig. 3.7 Outline of CRT Driver

3.2.2. Details of the CRT components

(1) Video buffer (Q14)

The video Signal Buffer consists of a buffer transistor and a peaking coil for increasing the gain in the high frequency zone. Its output is directly input to the CRT.

Transistor Q14 turns on when a HIGH level signal is sent from the Control PCB, and the electric potential of CRT cathode goes into the LOW level. When the cathode comes into the LOW level, the potential difference from Grid 1 of the CRT, which controls the thermion flow rate, becomes small; therefore, the amount of electrons to pass through Grid 1 increase and the fluorescent screen luminance.

(2) CRT circuit

The amount of thermions and the acceleration rate are controlled by the voltage of power supplied from the CRT high voltage circuit.

(2-1) Grid 1 Circuit (G1A)

The potential difference from the cathode controls the amount of thermions. When the potential difference between the cathode and Grid 1 is larger, most thermions are absorbed by Grid 1 and will not pass through. As a result the display will dim or disappear. The potential of Grid 1 is adjusted by VR67 (SUB.BRIGHT), VR68 (MIN.BRIGHT) and VR63 (BRIGHT).

(2-2) Grid 2 circuit and Grid 4 Circuit

These circuits accelerate electrons which have passed through Grid 1. Grid 2 is mostly constant at 500V. Grid 4 is adjustable with VR64 (FOCUS). When the electric potential of Grid 4 is high, electrons are further accelerated and the center is focused soft; When the potential is low, rim area is focused soft.

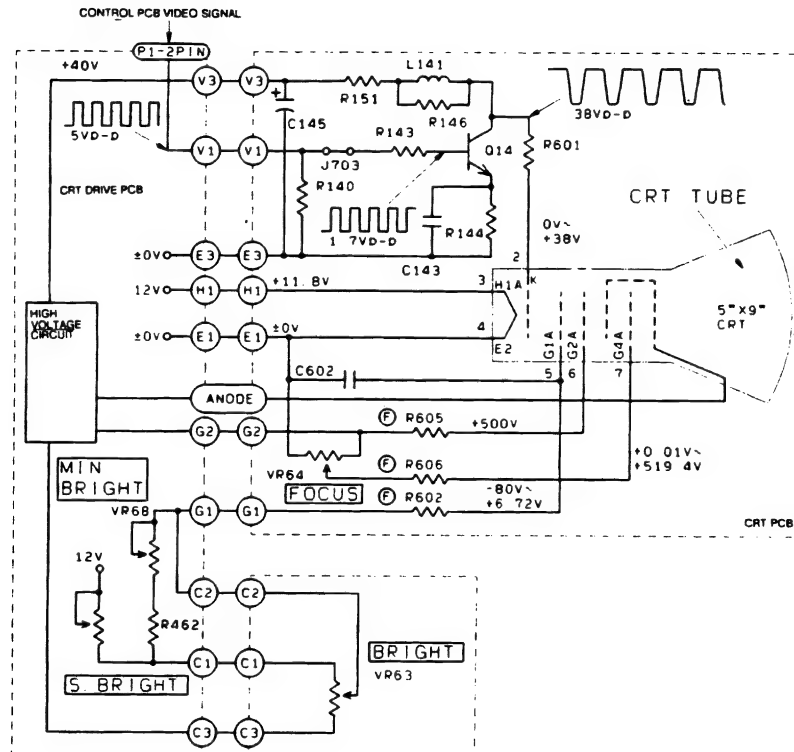


Fig. 3.8 Video and CRT Circuits

(3) Horizontal Deflection Circuit (IC41)

The horizontal deflection circuit basically consists of an AFC circuit to automatically control the variation in the oscillated frequency, a self-oscillating circuit and a pre-drive circuit to amplify the oscillation voltage. The operations are carried out by the horizontal control IC (IC41) and an external element.

The AFC circuit detects the phase of a horizontal synchronization signal which has been charged to the horizontal deflection control IC (IC41) and an actual waveform from the output circuit. The signal is converted by a rectifying circuit into DC and feedback to the oscillating circuit as an AFC voltage.

A horizontal deflection pulse is formed with this feedback and self-oscillation by the oscillating circuit, amplified to the voltage necessary for the output circuit, and then output from Pin 7. The VR41 (H.HOLD), connected to Pin 9, controls the AFC voltage and adjusts the horizontal synchronizing position.

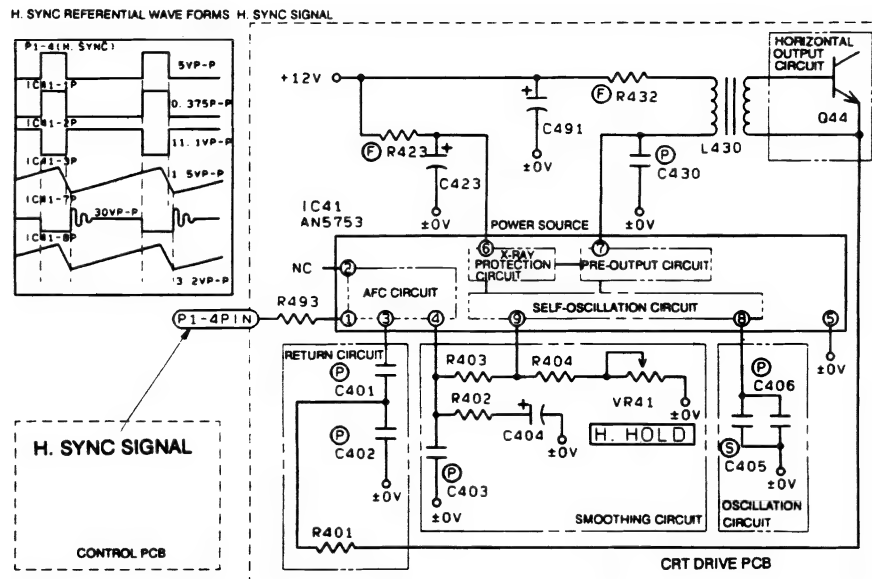


Fig. 3.9 Horizontal Deflection Circuit

(4) Horizontal Output Circuit (Q44) and High-Voltage Circuit (T401)

In the horizontal output circuit, horizontal output transistor Q44 turns on and off by the output from Pin 7 of the horizontal deflection control IC (IC41) at the previous stage.

When Transistor Q44 turns on, a corrector current passes through the deflection coil linearly in terms of time. Even after the transistor turns off, the current continues to flow and charges the capacitor for oscillation. Next, in the opposite direction, a current flows from the oscillation capacitor to the deflection coil. A sawtooth current of 16.2 KHz passes through the deflection coil in this way. Diode D46 is installed to function as a damper to control the oscillation phenomena. L403 (WIDTH) changes the amount of inductance and controls the amount of current to pass through the deflection coil.

The high voltage circuit charges a corrector voltage, generated in the above-mentioned sawtooth process, to a fly-back transformer (T401) and further increases the voltage to create the high voltage necessary for the CRT anode and the low voltage necessary for G1, G2 and G4. A diode and a capacitor are installed on the output side of the fly-back transformer (T401) to rectify and stabilize the supply power of the higher voltage.

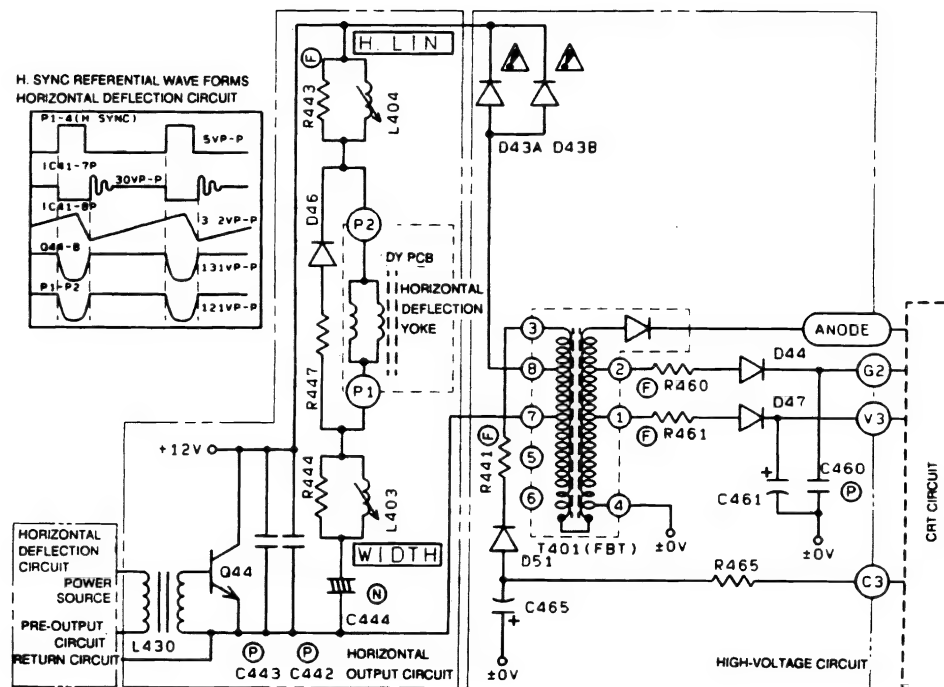


Fig. 3.10 Horizontal Output High-voltage Circuit

(5) V.SYNC Buffer (Q17)

This buffer reverses the polarity of the vertical synchronization signals from the Control PCB and converts them into the voltage required by the vertical circuit.

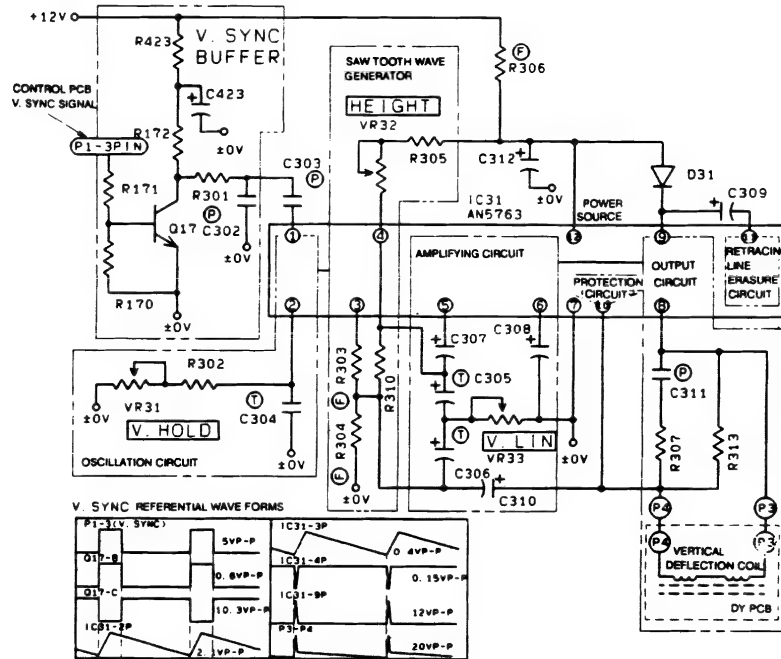


Fig. 3.11 Vertical Deflection Circuit

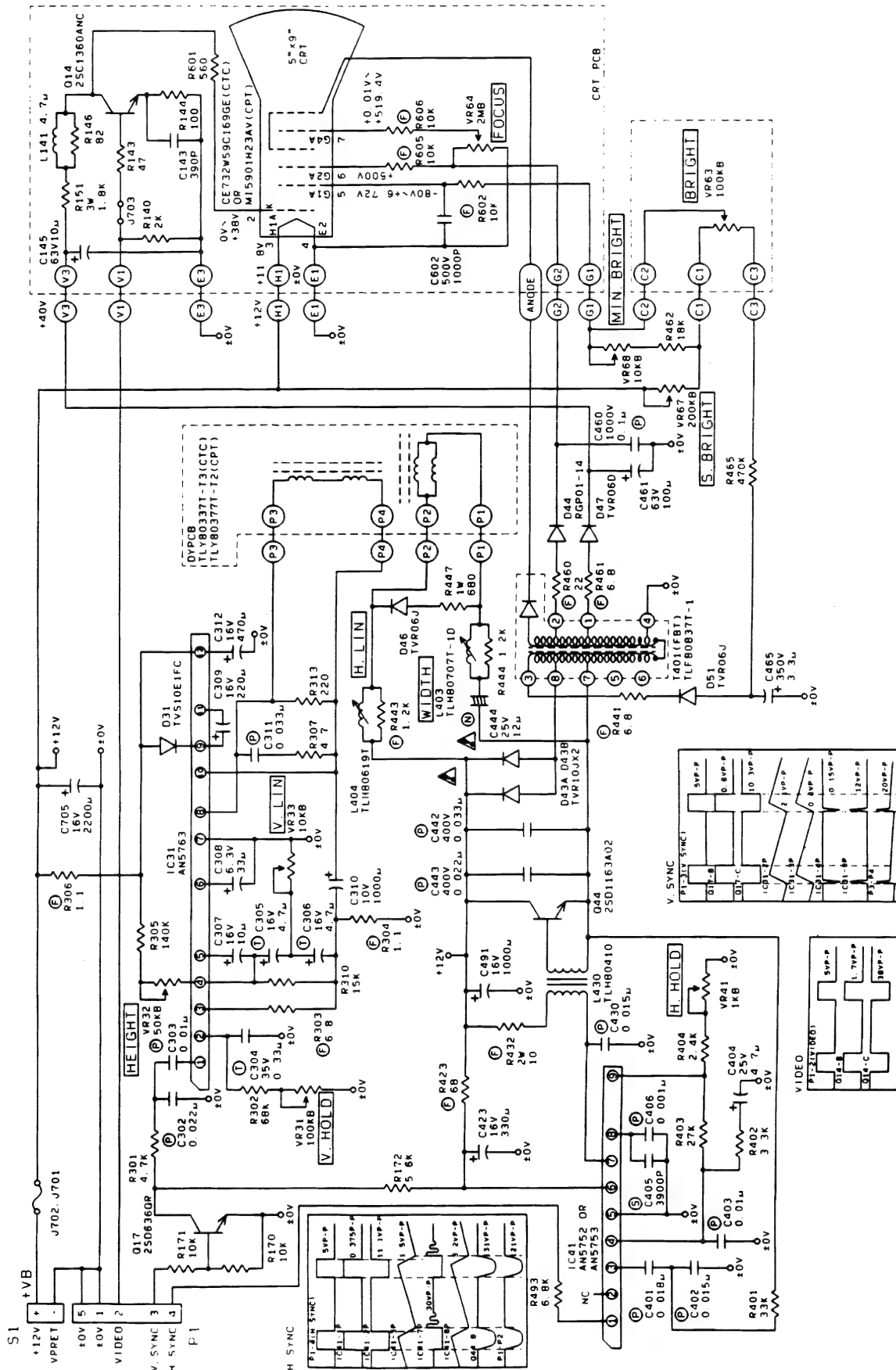
(6) Vertical Deflection Circuit (IC31)

The vertical deflection circuit consists of an oscillation circuit, a sawtooth amplification and shaping circuit and an output circuit, with most of them being operated by a vertical deflection control IC (IC31) and its external components.

The oscillation circuit is of a self-excitation type but driven and synchronized by vertical synchronization signals from the V.SYNC buffer. VR31 (H.HOLD) is connected to the base of a transistor inside the oscillation circuit to control the oscillation start point and adjust the synchronizing point.

The oscillated waveforms are then transmitted to the sawtooth wave generation circuit and converted into sawtooth waves. VR32 (HEIGHT) adjusts the sawtooth wave amplification and eventually controls the amount of current to be supplied to the vertical deflection coil. VR33 (HLIN) controls the linear property of the sawtooth waves.

The sawtooth waves are amplified by the output circuit and output from Pin 8 to be charged to the deflection coil; a sawtooth wave current passes through the deflection coil.



4. FLOPPY DISK DRIVE (FDD) CONTROL

4.1. Configuration of the FDD Electronic Parts

Fig. 4.1 shows the configuration of the electronic components of the FDD. The FDD is controlled by CPU #3, FDC #1, and Gate Array #2.

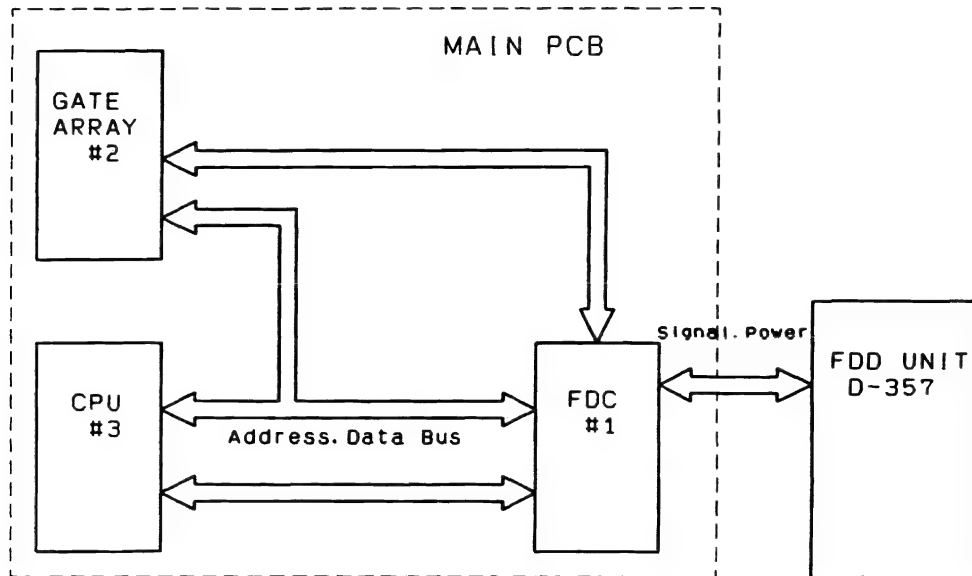


Fig. 4.1 Configuration of FDD Unit

4.1.1. FDC #1

FDC #1 is an LSI to control the FDD. This FDC incorporates such functions as controlling FDD data write/read, initializing an FD, and controlling the electronic components of the FDD. The features of FDC #1 (HD63266) are shown below:

- * Built-in analog VFO (Variable Frequency Oscillator)
- * Built-in driver circuit
- * Built-in Schmidt trigger input receiver circuit
- * Built-in clock signal generator circuit (16 MHz, 19.2 MHz)
- * Four output ports; one input port
- * Compatible with any standard FDC

4.1.2. Gate array #2

This generates FDC, RD, WR, and DACK signals to control FDC #1 using CPU #3 address and I/O control signals.

4.2. FDD Operation

4.2.1. FDD basic operations

CPU #3 writes commands to FDC #1. FDC #1 controls the FDD in accordance with that command and reads/writes data.

4.2.2. Interface between CPU #3 and FDC #1

If the CPU #3 accesses another internal register than the data register in FDC #1, the normal read/write operation will be performed. If CPU #3 transmits/receives data to/from FDC #1, DMA communications will be performed using the DMA function of CPU #3. In the latter case, data is transmitted/recieved using the DACK signal.

4.3. Interface Signals

FDC #1 located on the Control PCB is connected to the FDD unit by flexible cables (24p).

Table. 4.1 Signal Interface Connections

No.	Signal Name	No.	Signal Name
1	+5 V	2	+5 V
3	N.C.	4	+5 V
5	+5 V	6	READY
7	GND	8	GND
9	SIDE 1 SELECT	10	GND
11	READ DATA	12	WRITE PROTECT
13	TRACK 00	14	WRITE GATE
15	GND	16	WRITE DATA
17	GND	18	STEP
19	DIRECTION SELECT	20	MOTOR ON
21	N.C.	22	DRIVE SELECT 0
23	INDEX	24	DISK CHANGE

4.3.1. FDD unit ← FDC signal

(1) DRIVE SELECT 0 (Pin 22)

Operating the FDD unit sets this signal to LOW (except for the DC Motor).

(2) MOTOR ON (Pin 20)

When a disk is in the drive, independently of the status of DRIVE SELECT, this signal becomes LOW, starting the DC Motor. Setting this signal to HIGH or removing the disk stops the DC Motor.

(3) DIRECTION SELECT (Pin 19)

This signal designates movement of a read/write head.

LOW: Inward to the disk's center

HIGH: Outward from the disk's center

(4) STEP (Pin 18)

This signal sets the head in the direction designated by the DIRECTION SELECT signal.

(5) WRITE DATA (Pin 16)

Data is written at the falling edge of this signal while the WRITE GATE signal is LOW.

(6) WRITE GATE (Pin 14)

Setting this signal to LOW enables data to be written by the WRITE DATA signal.

Setting this signal to HIGH enables the READ and STEP operations.

(7) SIDE 1 SELECT (Pin 9)

Select a head using this signal:

LOW: Head 1

HIGH: Head 0

4.3.2. FDD unit → FDC signal

(1) INDEX (Pin 23)

This signal indicates the beginning of a track, outputting one pulse per each disk rotation.

(2) TRACK 00 (Pin 13)

When this signal is LOW, the head is located on track 00 (the outside track).

Otherwise, the signal is HIGH.

(3) WRITE PROTECT (Pin 12)

When this signal is LOW, either there is no disk in the drive or a write-protected disk is in the drive.

(4) READ DATA (Pin 11)

This signal indicates polarity data read by the head.

(5) READY (Pin 6)

When this signal is LOW, data can be read/written from/to the disk.

(6) DISK CHANGE (Pin 24)

When this signal is LOW, there is no disk in the drive.

4.4. FDD Unit

Table. 4.2 gives the performance specifications of the 3.5-inch floppy disk drive unit (D-357).

Table. 4.2 FDD Unit Performance Specifications

Items			MFM
Memory Capacity	Disk	Not formatted 8in units of K-bytes)	1000
		Formatted (in units of K-bytes)	720
	Track	Not formatted (in units of bytes)	6250
		Formatted (in units of bytes)	4608
Recording Density	Recording density of the inside track (BPI)		8717
	Data transmission speed (1000 bits/sec)		250
	Number of heads		2
	Number of tracks		160
	Track density (TPI)		135
Access Time	Access time between tracks (msec)		6 (min)
	Setting time (msec)		15 (min)
Motor Performance	Revolutions (rpm)		300
	Startup time (sec)		0.4 (max.)

5. POWER SUPPLY UNIT

5.1. Configuration

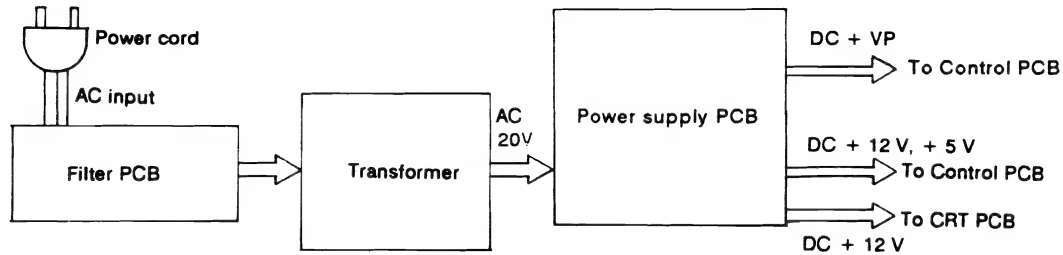


Fig. 5.1 Configuration of Power Supply Unit

Fig. 5.1 shows the configuration of the power supply unit. The unit consists of a filter PCB, a transformer and a power supply PCB.

The voltage conversion method is explained below relating to the power supply unit circuits shown in Fig.5.2:

When power switch SW1 is turned on, an AC voltage is input through the power cord and then through P302 into a transformer. The transformer functions to increase the AC voltage into 30V AC which is supplied to the power supply PCB.

The power supply PCB converts the more than +20V AC, input from P401, initially +30 V (unstable) through diode bridge DB1 and capacitor C4;

This +30V DC is supplied to Main PCB from P402;

This +30V DC is converted into +12V DC (stable) through chopper-type switching regulator #1 and power transistor Q1. And this +12 V is supplied to Main PCB from P402 and CRT PCB from P403.

This +12 V DC is converted into +5 V (stable) through the resistor R4, R5 and dropper-type regulator Q2. And this +5 V is supplied to Main PCB from P402.

#1 is a stepdown switching regulator incorporated the sawtooth oscillator, error amplifier and comparator. The gain and frequency is decided by R7, C10 and C11. #1 senses the output voltage through the R8 and R9 and controls the base of Q1 to step-down from +30V (unstable) to +12V (stable).

In the case of an overload due to a short on the +30V DC circuit, Fuse F1 on the filter PCB or Fuse F2 on the power supply PCB will be blown.

Specifications of Fuses on the Filter PCB and the Power Supply PCB

AC Input Spec.	Fuse F1	Fuse F2
110V AC to 127V AC	1.6 A (UL and CSA approved)	3 A (UL and CSA approved)
200V AC to 240V AC	800 mA (SEMKO approved)	3 A (SEMKO approved)
100V AC	1.6 A (Japan Electric Appliances Safety Standards approved)	3 A

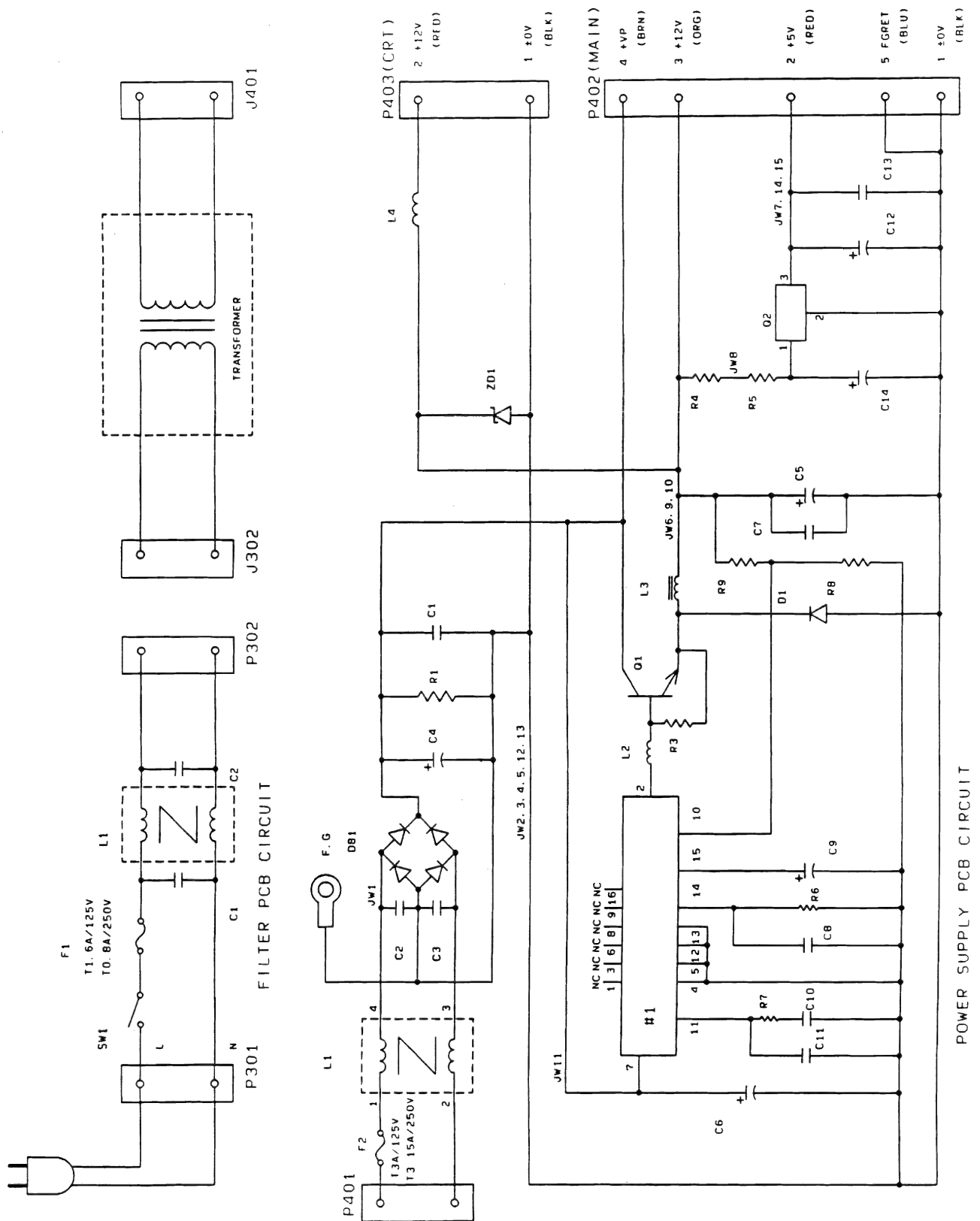


Fig. 5.2 Circuit Diagram of Power Supply Unit

6. SELF-TESTING

6.1. Type of Tests

(1) Self-printing mode

Press the CODE + SHIFT + RETURN keys in the T/W mode to start.

(2) ROM and RAM check

Press the CODE + SHIFT + RETURN keys in the T/W mode.

(3) Self-testing (Mode 1)...for servicing

Press the CODE + SHIFT + BS keys in the T/W mode to start.

6.2. Self-printing Mode

SELF-PRINTING (RUNNING)	CODE + SHIFT + RETURN
-------------------------	-----------------------

<Start up>

Press the CODE + SHIFT + RETURN keys in the T/W mode.

ROM and RAM operation check is executed before self-printing and the result of check is displayed on the CRT. Self-printing is carried out only when all the ROMs and RAMs checked are correct.

***** SELF PRINT *****	
VIDEO RAM	... OK
MAIN ROM	... OK
DICTIONARY ROM	... OK
MAIN RAM	... OK

<Note>

1. Set the printing format in the following manner:
LINE = Follows the specific setting at that time.
PITCH = Follows the specific setting at that time.
LEFT MARGIN = LEFT END
RIGHT MARGIN = RIGHT END
TAB = No change
2. After the print job is cancelled, the format is reset.
3. Print bold characters and underline by selecting responding mode.
4. Print 90 characters in one line.
5. Printing speed changes as the BS key is pressed.
6. Press the space key, the printing stops and the display returns to the main menu.

¢!"#\$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopQRSTUVWXYZ[+], °abcdefghijklmnopqrstuvwxyz
i"#\$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopQRSTUVWXYZ[+], °abcdefghijklmnopqrstuvwxyz
"#\$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopQRSTUVWXYZ[+], °abcdefghijklmnopqrstuvwxyz
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56789:;<=>?@ABCDEFGHIJKLMNopQRSTUVWXYZ[+], °abcdefghijklmnopqrstuvwxyz
6789:;<=>?@ABCDEFGHIJKLMNopQRSTUVWXYZ[+], °abcdefghijklmnopqrstuvwxyz
789:;<=>?@ABCDEFGHIJKLMNopQRSTUVWXYZ[+], °abcdefghijklmnopqrstuvwxyz
8

6.3. ROM and RAM check

ROM and RAM check	CODE + SHIFT + RETURN
-------------------	-----------------------

<Start up>

See Self-printing mode.

6.4. Self-testing (Mode 1)

6.4.1. General

<Start up>

Press the CODE + SHIFT + BS keys in the T/W Mode, and the following MENU will be displayed.

<MENU display>

***** SELF TEST MENU *****	
CRT	1, 2, 3, 4
PRINTER	5
KEYBOARD	6, 7, 8
DETENT	9
CR/LF	A
Please select the number. Press TW/WP to finish.	

- (1) Press the item number key on the above MENU, the test program of the corresponding item will start.
- (2) To return to the menu screen during the self-test, press the any keys.
- (3) Press the TW/WP key with the above MENU, and the main program will start.
- (4) While the MENU is displayed, any input except by the above-mentioned numerical or alphabet keys, or TW/WP key will be an error.

6.4.2. CRT screen tests

1. FRAME	Check for vertical, lateral/horizontal deviation
----------	--

<Operation>

Select "1" on the MENU screen to display the following check pattern:

-----	-----
HHH	HHH
HHH	HHH
HHH	HHH
	HHH
-----	-----
	HHH
	HHH
HHH	HHH
HHH	HHH
HHH	HHH
-----	-----

<Contents>

- 1 Check for the display's vertical, lateral and horizontal deviation by sampling hyphens and vertical bars.
2. Check for brightness and focusing with HHH.

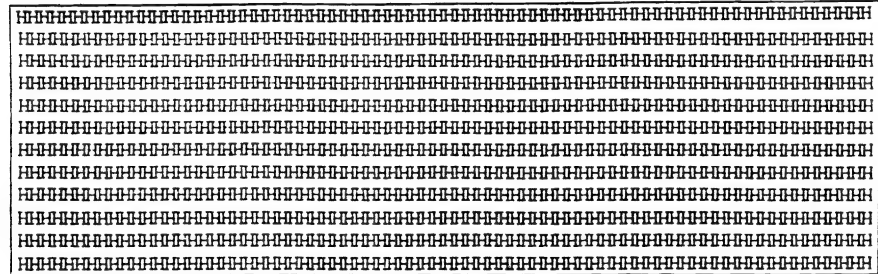
<Note>

1. Return to the MENU by pressing the any keys.

2. H PATTERN	Check for focusing and back raster
--------------	------------------------------------

<Operation>

Select "2" on the MENU screen to display the pattern below:



Display "H" all over the screen to check for focusing and back raster.

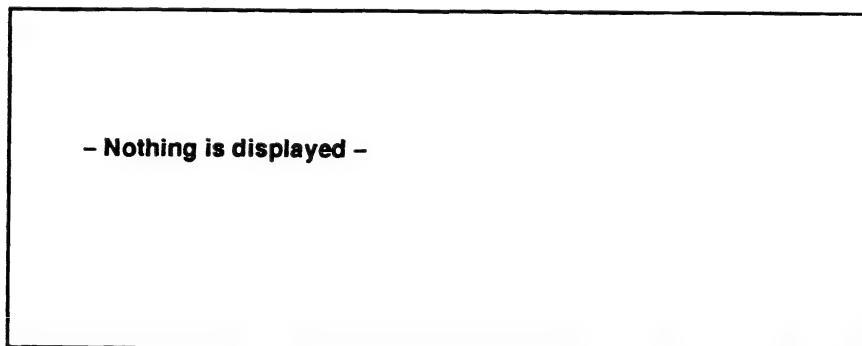
<Note>

1. Return to the MENU by pressing the any keys.

3. BLANK SCREEN	Check for back raster
-----------------	-----------------------

<Operation>

Select "3" on the MENU screen to display the below:



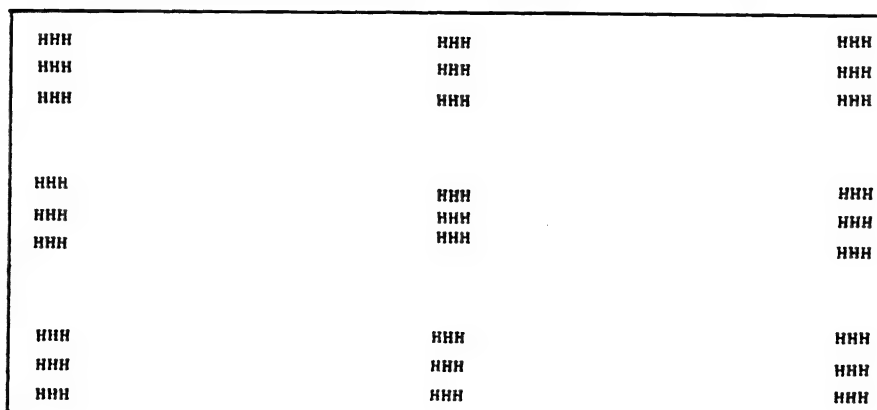
<Note>

1. Return to the MENU by pressing the any keys.

4. H BLOCKS	Check for focusing
-------------	--------------------

<Operation>

Select "4" on the MENU screen to display the following check pattern:



<Contents>

1. Check for focusing with H BLOCKS.

<Note>

1. Return to the MENU by pressing the any keys.

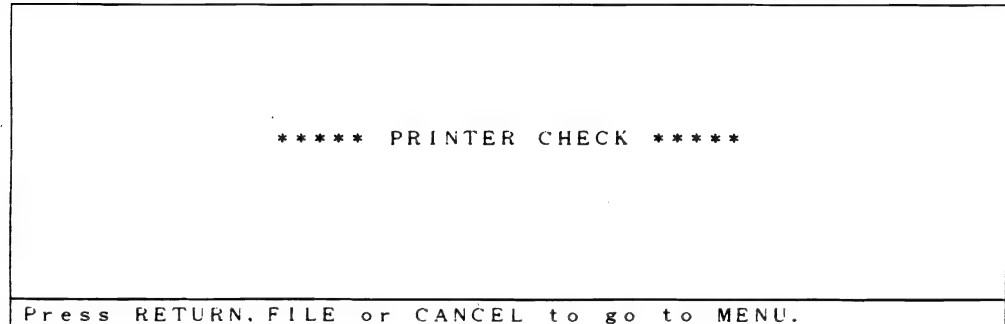
6.4.3. Printing tests

5. PRINTER CHECK	Check for printing, erasing, alignment etc.
------------------	---

INSPECTION PATTERN Check for printing performance

<Operation>

Select "5" on the MENU screen to display the following image for starting printing test patterns (see the example).



<Contents>

1. Check for unclear printing, and erroneous or damaged characters by using all the font characters.
2. Check for double printing by using, "kf.....+Le" pattern.
3. Print alignment
Print 26 upper case characters and check their print alignment.
4. Print "FGHWW" in bold and check the bold printing quality.
5. Correct some normally printed characters to check the correcting performance.
6. Check for inclination and skipping of printing by using printing underline characters continuously.
7. Check for paper guide position and ribbon lift by printing "I | I....." pattern. Also check for correction ribbon lift and ribbon feed by printing and correcting "33pp" pattern.

<Notes>

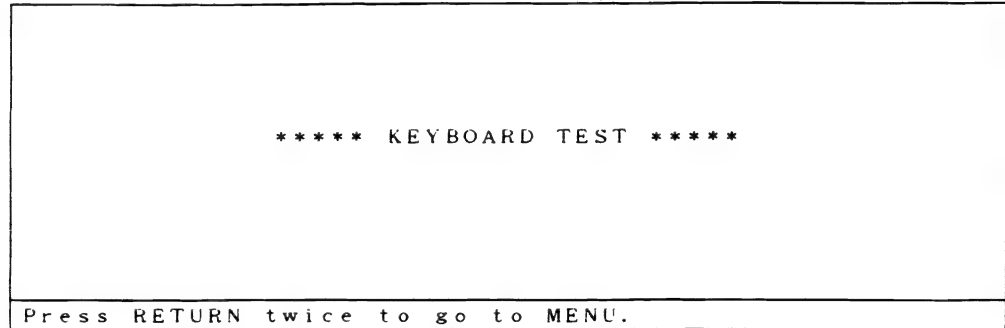
1. Print Pitch: 10 and line: 1
2. Press the RETURN or FILE or CANCEL key to stop printing immediately and return to the MENU.

6.4.4. Keyboard tests

6, 7, 8 KEYBOARD TEST	Check for proper contact of key contacts in the keyboard.
-----------------------	---

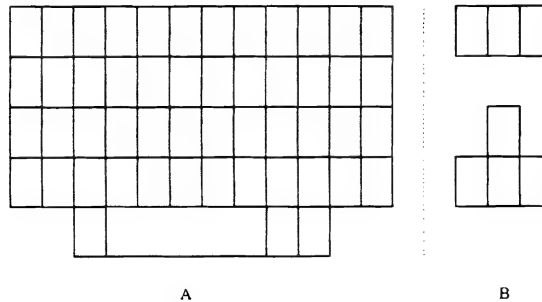
<Operation>

Select "6", "7", or "8" on the MENU screen to display the following image for starting the keyboard tests.



<Mode>

- "6" key : Check of the key contacts in the A area
- "7" key : Check of the key contacts in the B area
- "8" key : Check of the key contacts in the A and B areas



<Contents>

1. Sequentially press each key on the keyboard in the following manner: from left to right on the top row, from right to left on the second row, and from left to right on the third row.
2. For the keyboard test called by pressing "6" or "8" key, press the following two-key combinations after pressing all the keys in test step 1 above.
 - [SHIFT] (left) + [Z]
 - [SHIFT] (right) + [/]
 - [CODE] + [SPACE]
3. After the test, an beep will sound when there are no errors. At the same time "KEYBOARD TEST OK" message will be printed.
4. For the keyboard test called by pressing "7" key, "KEYBOARD TEST" message will be printed automatically after the seven keys in B area have been pressed.

<Note>

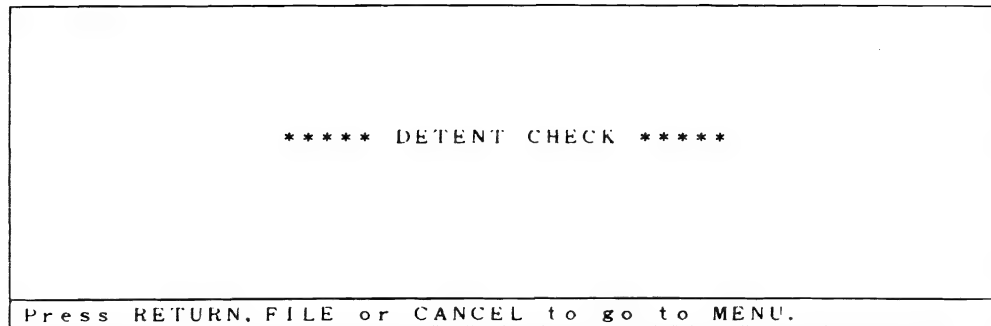
1. If the keys are pressed in a wrong sequence, a beep will sound. The test can be continued if the correct key is pressed.
2. Press the RETURN key twice to return the display to the MENU screen.

6.4.5. Detent check

9. DETENT CHECK	Check for correct detent adjustments.
-----------------	---------------------------------------

<Operation>

Select "9" on the MENU screen to display the following image for starting the detent check.



<Contents>

When a character key is pressed while this screen is displayed, the corresponding character is selected and the daisy wheel drive motor is kept excited. The daisy wheel drive motor will remain excited for a preset period (several tens seconds).

<Note>

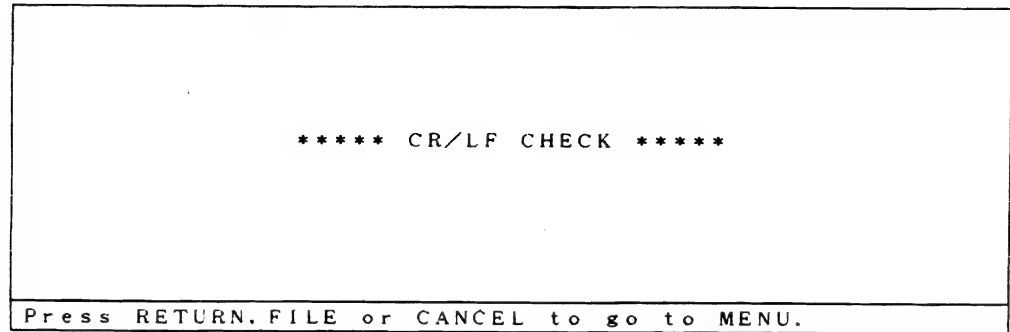
1. Press the RETURN, FILE, or CANCEL key to return the display to the MENU screen.
2. In this test mode, carrier and hammer are not operated.

6.4.6. CR/LF check

A. CR/LF CHECK	Checking for beep sounding when TAB, RETURN, SPACE, BS, or LF key is pressed.
----------------	---

<Operation>

Select "A" on the MENU screen to display the following image for starting the CR/LF check.



<Contents>

1. TAB.....Once
2. BS.....Backspacing by 30 pica pitches
3. SPACE.....Spacing by 30 pica pitches
4. RETURN.....Once
5. TAB.....Once
6. RETURN.....Once
7. LF feed.....30 LF feed (1/6" line feed pitches)
8. LF return30 LF return (1/6" line feed pitches)
9. After the completion of test mode, the display returns to the MENU screen.

<Note>

1. Press the RETURN, FILE, or CANCEL key to return the display to the MENU screen.

CHAPTER II TROUBLESHOOTING

1. General

This section describes methods for finding the possible causes of typewriter troubles. As it is impossible to tell when and how a trouble will occur, it is very difficult to establish trouble shooting procedures by assuming such troubles. Therefore, described here are limited examples but it is necessary to understand the functions of each block beforehand to be prepared for actual trouble so that you can roughly understand the malfunctioning part analytically studying the trouble.

2. Precautions

Observe the following precautionary instructions for safety during repair work:

- (1) Disconnect the power plug and AC receptacle before removing the cover, adjusting any mechanical parts or removing the PCBs etc.
- (2) Disconnect the power plug and an receptacle before checking continuity with a tester.
- (3) Do not pull on the lead cable when disconnecting a connector. Release the lock on a connector, if any, before disconnection.
(Hold the connector body to pull it out.)
- (4) Be sure to discharge any residual load on the anode before repairing the CRT unit.

3. Checking After Repair

After finding the cause of the trouble and repairing it, always test the unit to confirm that the trouble has been fully resolved by the repair work.

It is recommended to keep a record of troubleshooting procedures in each specific case for utilization in the future.

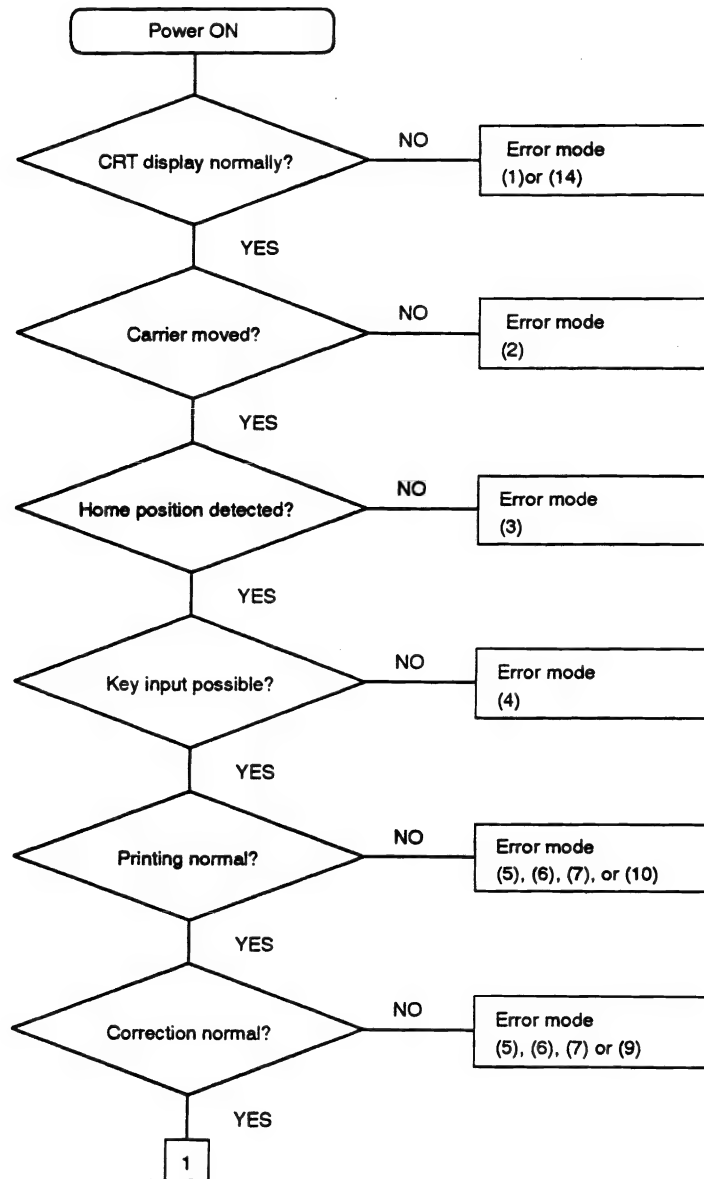
4. Primary Check Items

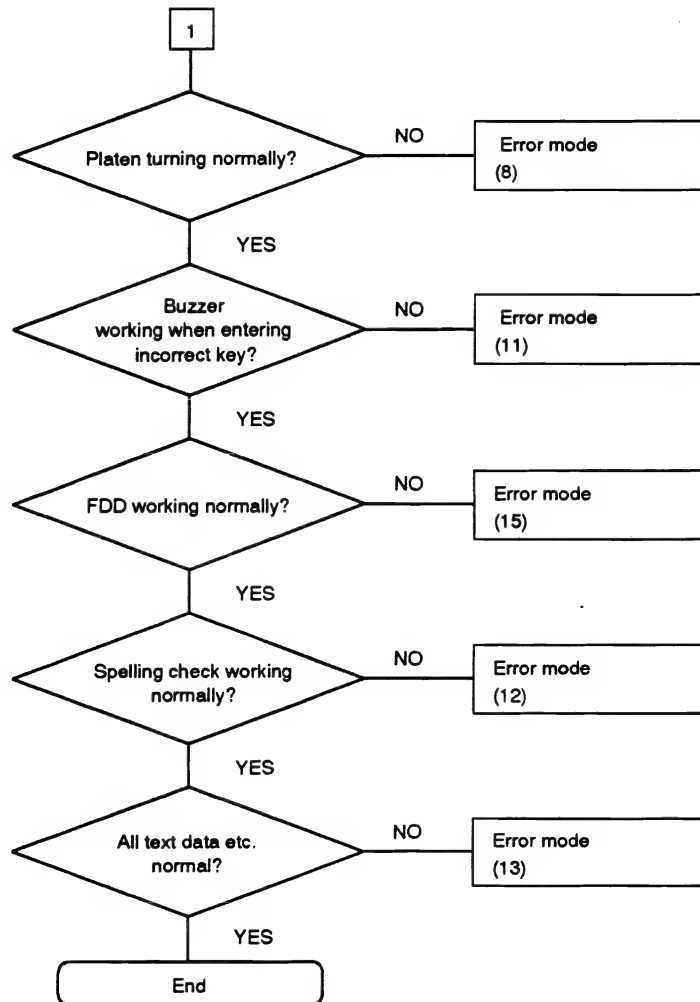
Check the following items as primary check items when trouble occurs:

- (1) Check the supply voltage
The AC supply voltage and DC supply voltage for each part are as specified.
- (2) Check the connector connections
Check that every connector connection exists and is secured
- (3) Check the fuses
Check for any blown fuse (F1, F2 and the thermo-fuse inside the transformer)

Notes: *In the case of logical control circuits, it is not easy to find a malfunctioning part in a component connected to the CPU by an address bus and a data bus or in the address bus and data bus connected from the GA to the VRAM, through simple checking procedures. In a case where a malfunctioning part is connected to the address bus or data bus, check the solder bridges and for any lock of pattern first. If the malfunctioning part cannot be found, replace the peripheral elements or the PCB.*

5. Troubleshooting Flowcharts





6. Error Modes

- | |
|---|
| 1 |
|---|

 No response after switching power on (no display on CRT).
- | |
|---|
| 2 |
|---|

 CRT display comes on after turning power switch on but carrier does not start home position detecting operation.
- | |
|---|
| 3 |
|---|

 Carrier moves left after turning power switch on but home position cannot be detected (Home Position Detection Error is displayed).
- | |
|---|
| 4 |
|---|

 Key entry is not always available; or some key entries are disabled.
- | |
|---|
| 5 |
|---|

 Abnormal daisy wheel drive motor rotation (mis-typing, etc.).
- | |
|---|
| 6 |
|---|

 Hammer does not strike (DC motor does not start).
- | |
|---|
| 7 |
|---|

 Hammer does not strike and ribbon is not wound on (DC motor does turn).
- | |
|---|
| 8 |
|---|

 LF motor does not turn normally.
- | |
|---|
| 9 |
|---|

 Ribbon does not lift when correcting; correction ribbon is not wound on.
- | |
|----|
| 10 |
|----|

 Printing is too light or too dark.
- | |
|----|
| 11 |
|----|

 A buzzer does not operate.
- | |
|----|
| 12 |
|----|

 Spelling check is disabled.
- | |
|----|
| 13 |
|----|

 Wrong text data etc. displayed.
- | |
|----|
| 14 |
|----|

 CRT does not show a normal display.
- | |
|----|
| 15 |
|----|

 FDD does not operate normally.

7. Error Mode Analysis Tables

Error Mode	Check Items	Causes	Countermeasures	Repair	Manual
No response after switching power on (no display on CRT).	Are power cord and harnesses connected properly?	Ineffective connection	Re-connect		5. POWER SUPPLY UNIT
	Is a fuse on Filter PCB blown?	Blown fuse	Replace fuse		
	Is supply voltage loaded between L and N of P301 on Filter PCB?	Wire break in AC power cord	Replace power cord if terminal block is used		
			Replace Filter PCB assembly if one not used.	Replace power cord	
		Ineffective contact with terminal block (if terminal block is used)	Replace Filter PCB assembly	Replace terminal block	
	Is supply voltage loaded on both ends of Capacitor C1 on the Filter PCB?	Defective power switch SW1	Replace Filter PCB assembly.	Replace SW1	
	Is supply voltage on both end of P302 on the Filter PCB?	Defective Coil 1	Replace Filter PCB assembly.	Replace L1	
	Is there more than 20 V AC output on secondary side of transformer during idling?	Defective transformer	Replace transformer		
	Is secondary voltage output on output side of Coil 1 on Power Supply PCB?	Defective Coil 1	Replace Power Supply PCB assembly	Replace L1	
	Approx. 30 V DC applied on both ends of Capacitor 4 on Power Supply PCB?	Defective Diode Bridge DB1	Replace Power Supply PCB assembly	Replace DB1	

1

Error Mode	Check Items	Causes	Countermeasures	Repair	Manual
No response after switching power on (no display on CRT).	Is there +VP (approx. 30 V) DC output at Pin 4 of P402? (Leave Connector P215 on CRT PCB and P216 on Control PCB disconnected.)	Defective Zenner-diode ZD1	Replace Power Supply PCB assembly	Replace ZD1	5. POWER SUPPLY UNIT
		Defective Transistor Q1		Replace Q1	
		Defective chopper-type Reg. # 1		Replace #1	
		Defective Diode D1		Replace D1	
		Wire break in harness assembly		Replace harness assy.	
	Are there +12 V DC output at Pin 3 of P403 Pin 3 of P402 on Power Supply PCB? (Leave Connector P215 on CRT PCB and P216 on Control PCB disconnected.)	Defective Zenner-diode ZD1	Replace Power Supply PCB assembly	Replace ZD1	
		Defective Transistor Q1		Replace Q1	
		Defective chopper-type Reg. # 1		Replace #1	
		Defective Diode D1		Replace D1	
		Wire break in harness assembly		Replace harness assy.	
	Is there +5 V DC output at Pin 2 of P402? (Leave Connector P215 on CRT PCB and P216 on Control PCB disconnected.)	Defective Zenner-diode ZD1	Replace Power Supply PCB assembly	Replace ZD1	
		Defective Transistor Q1		Replace Q1	
		Defective chopper-type Reg. # 1		Replace #1	
		Defective Diode D1		Replace D1	
		Defective dropper-type Reg. Q2		Replace Q2	
		Wire break in harness assembly		Replace harness assy.	

Error Mode	Check Items	Causes	Countermeasures	Repair	Manual
No response after switching power on (no display on CRT).	Are any parts overheated?	Defective element	Replace Power Supply PCB	Replace defective parts	2. CONTROL PCB'S AND THE PERIPHERALS
	Is +5 V applied to Pin 2 and +12 V power applied to Pin 3 of P216 when connector P216 on Control PCB is connected? Are Pins 1 and 5 continuing?	+12 V and +5 V shortcircuiting on Control PCB	Replace Control PCB		
	1) Are any parts overheated?	Defective element		Replace defective parts	
	2) Are there any solder bridges or solder chips?	Solder bridge		Remove solder bridges and solder chips	
	Is signal level at reset circuit HIGH? (Pin 7 of CPU #3, Pin 144 of GA #2)	Defective Transistor Q4	Replace Power Supply PCB assembly	Replace Q4	
		Defective Transistor Q3		Replace Q3	
	Is oscillation waveform (12.288 MHz) output at Pins 2 and 3 of CPU #3?	Defective XT3	Replace Control PCB	Replace XT3	
		Defective #3		Replace #3	
	Are Solder Points S0 to S7 properly connected?	Ineffective connection	Re-connect		
	Is ROM installed in correct direction?	Ineffective installation	Re-install		
	Are pulses output as control signals, address bus and data bus at CPU #3?	Defective #3	Replace Control PCB	Replace #3	
CRT displays on turning power switch on but carrier does not start home position detecting operation.	Is LOW input at PBO of Gate Array #2 when cover is closed?	Wire break in cover switch assembly	Replace cover switch assembly		2.3 Control of Motors, Magnets and Switches
		Defective cover switch installation	Re-assemble		

Error Mode	Check Items	Causes	Countermeasures	Repair	Manual
CRT displays on turning power switch on but carrier does not start home position detecting operation.	Are carrier motor drive pulses output at PD0, PD1, PD2 and PD3 of Gate Array #2 immediately after switching power on?	Defective #2	Replace Control PCB assembly	Replace #2	2.3 Control of Motors, Magnets and Switches
	Are output pins 1, 2, 3 and 4 of P212 turned on and off by above pulses?	Defective QA1 or defective circuit		Replace QA1	
	1) +12 V applied to Pins 5 and 6 of Connector P212?	Defective +12 V supply	Replace Control PCB assembly		
	2) Resistance between COM terminal of carrier motor and each phase normal? (20 Ω)	Wire break in carrier motor assembly	Replace carrier motor assembly		
	3) Is QA1 output level normal?	Defective QA1	Replace Control PCB assembly	Replace QA1	
Carrier moves left after turning power switch on but home position cannot be detected (Home Position Detection Error is displayed).	Is connector part of carrier index switch correctly connected to P206?	Ineffective connection	Re-connect		2.4 Keyboard PCB
	Is PB2 of Gate Array #2 input at LOW on turning carrier index switch on?	Wire break in carrier index switch assembly	Replace carrier index switch assembly		
	Is carrier index switch pressed?	Faulty adjustment of carrier index switch assembly	Re-adjust		
Key entry is not always effective; or some key entries are disabled.	Is keyboard PCB properly installed?	Faulty assembly work	Re-assemble		2.4 Keyboard PCB
	Is Keyboard PCB properly connected to P211?	Ineffective connection at connector part	Re-connect		
	Is a LOW signal input to K10 to K17 of GA #2 when an ineffective key is pressed and line for the key is synchronized with output of K00 to K08 of GA #2?	Pattern break on Keyboard PCB	Replace Keyboard PCB		
	Is a LOW signal output for each line from Output Pins K00 to K08 on GA #2?	Defective #2	Replace Control PCB assembly	Replace #2	

3

4

Error Mode	Check Items	Causes	Countermeasures	Repair	Manual
Abnormal daisy wheel drive motor rotation (mis-typing, etc.).	Is daisy wheel installed properly?	Faulty installation	Re-install		2.3 Control of Motors, Magnets and Switches
	Is connector part of wheel motor properly connected to P214?	Ineffective connection	Re-connect		
	Are wheel motor drive pulses output from PE0, PE1, PE2 and PE3 on Gate Array #2?	Defective #2	Replace Control PCB assembly	Replace #2	
	Are output pins 1, 2, 3 and 4 of P214 turned on and off by above drive pulses?	Defective QA2 or defective circuit	Replace Control PCB assembly	Replace QA2	
	1) Are the following voltages applied to Pins 5 and 6 of Connector P214: Driving time: +12 V Weak excitation time: +2.27 V (approx.)?	Pattern break			
		Defective #2		Replace #2	
		Defective Q1		Replace Q1	
		Defective Q2		Replace Q2	
		Defective R21		Replace R21	
	2) Is resistance between COM terminal of wheel motor and each phase normal (35 Ω)?	Wire break in wheel motor assembly	Replace wheel motor assembly		
	3) Is QA2 output level normal?	Defective QA2	Replace Control PCB assembly	Replace QA2	
	Inspect related mechanical parts and components.				

Error Mode	Check Items	Causes	Countermeasures	Repair	Manual
Hammer does not strike (DC motor does not start).	Is a DC motor drive signal output from PG0 of Gate Array #2?	Defective #2	Replace Control PCB assembly	Replace #2	2.3 Control of Motors, Magnets and Switches
	Are Output Pins 2 and 7 of Drive IC QA3 turned on and off by above signal?	Defective QA3 or defective circuit	Replace Control PCB assembly	Replace QA3	
	1) Is +12 V applied to Pin 2 of Connector P201?	Faulty +12 V power supply			
	2) Does resistance between poles remain infinite when DC motor is rotated manually?	Wire break in DC motor assembly	Replace DC motor PCB assembly		
	3) Is QA3 output voltage at normal level?	Defective QA3	Replace Control PCB assembly	Replace QA3	
Hammer does not strike and ribbon is not wound on (DC motor does turn).	Inspect related mechanical parts and components.				2.3 Control of Motors, Magnets and Switches
	Is ribbon magnet drive pulse output from PG1 of Gate Array #2?	Defective #2	Replace Control PCB assembly	Replace #2	
	Is Output Pin 15 of Drive IC QA3 turned on and off by above drive pulse?	Defective QA3 or defective circuit	Replace Control PCB assembly	Replace QA3	
	1) Is +12 V applied to Pin 2 of Connector P205?	Faulty +12 V power supply			
	2) Is resistance between poles of ribbon magnet normal?	Wire break in ribbon magnet assembly	Replace ribbon magnet assembly		
	3) Is QA3 output voltage at normal level?	Defective QA3	Replace Control PCB assembly	Replace QA3	
	Inspect related mechanical parts and components.				

6

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8

Error Mode	Check Items	Causes	Countermeasures	Repair	Manual
LF motor does not turn normally.	Are LF motor drive pulses output from PF0, PF1, PF2 and PF3 of Gate Array #2?	Defective #2	Replace Control PCB assembly	Replace #2	2.3 Control of Motors, Magnets and Switches
	Are Output Pins 1, 2, 3 and 4 of P213 turned on and off by above pulses?	Defective QA2 or defective circuit	Replace Control PCB assembly	Replace QA2	
	1) Is +12 V applied to Pins 5 and 6 of Connector P213?	Faulty +12 V power supply			
	2) Is resistance between poles normal (20 Ω)?	Wire break in LF motor assembly	Replace LF Motor PCB assembly		
	3) Is QA2 output voltage at normal level?	Defective QA2	Replace Control PCB assembly	Replace QA2	
Ribbon does not lift when correcting; correction ribbon is not wound on.	Inspect related mechanical parts and components.				2.3 Control of Motors, Magnets and Switches
	Is correction magnet drive pulse output from PG2 of Gate Array #2?	Defective #2	Replace Control PCB assembly	Replace #2	
	Is Output Pin 10 of Drive IC QA3 turned on and off by above drive pulse?	Defective QA3 or defective circuit	Replace Control PCB assembly	Replace QA3	
	1) Is +12 V applied to Pin 2 of Connector P204?	Faulty +12 V power supply			
	2) Is resistance between poles of correction magnet normal?	Wire break in correction magnet assembly	Replace correction magnet assembly		
	3) Is QA3 output voltage at normal level?	Defective QA3	Replace Control PCB assembly	Replace QA3	
	Inspect related mechanical parts and components.				

9

Error Mode	Check Items	Causes	Countermeasures	Repair	Manual
Printing is too light or too dark.	Is ribbon magnet drive pulse width normal?	Defective Gate Array #2	Replace Control PCB assembly	Replace #2	2.3 Control of Motors, Magnets and Switches
	Inspect related mechanical parts and components.				
A buzzer does not operate.	Are 4 KHz pulses applied to Buzzer BZ1 when error is occurred?	Defective Gate Array #2	Replace Control PCB assembly	Replace #2	2.2 CPU Peripherals
		Defective BZ1		Replace BZ1	
		Defective XT2		Replace XT2	
Spelling check is disabled.	Was "DICTIONARY ROM ... OK" displayed as result of Self-printing mode?	Ineffective connection at solder point S0 to S7.	Re-connect		2. Control PCB's and the Peripherals
		Defective #6		Replace #6	
		Defective #2		Replace #2	
	Was "MAIN ROM ... OK" displayed as result of Self-printing mode?	Ineffective connection at solder point S0 to S7.	Re-connect		
		Defective #6		Replace #6	
		Defective #2		Replace #2	

10

11

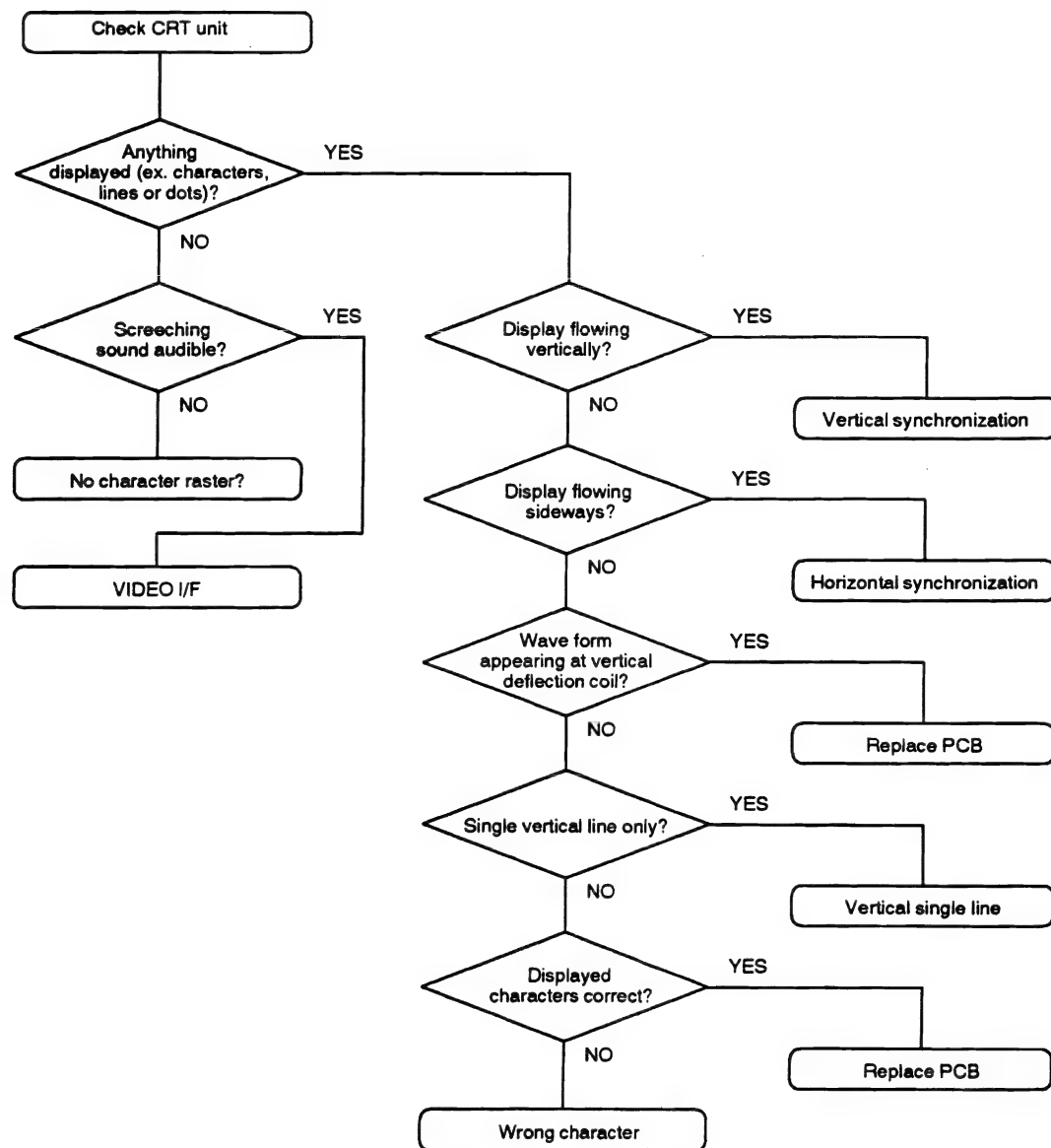
12

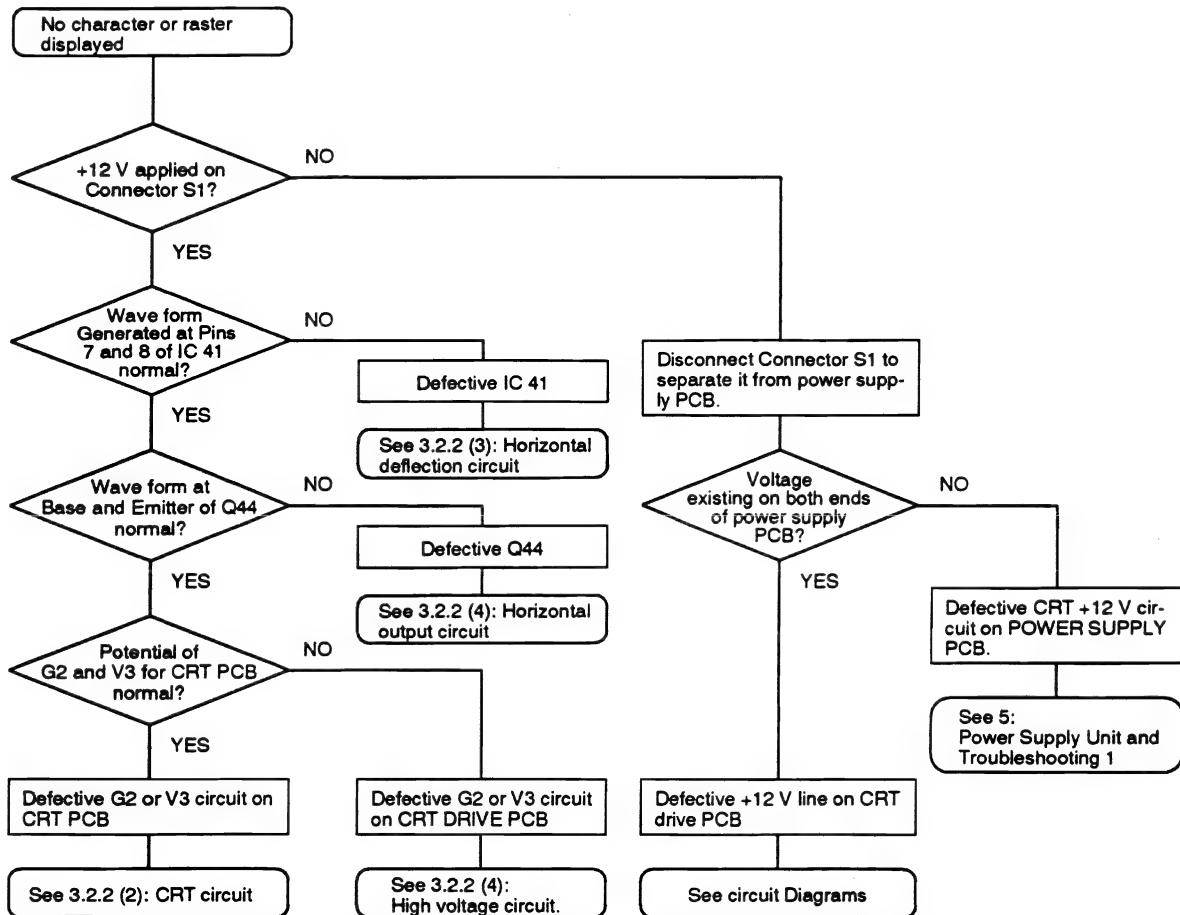
Error Mode	Check Items	Causes	Countermeasures	Repair	Manual
Wrong text data etc. displayed.	Was "VIDEO RAM ... OK" displayed as result of Self-printing mode?	Defective #4		Replace #4	6.2 Self-Printing Mode
		Defective #2		Replace #2	
	Was "MAIN RAM... OK" displayed as result of Self-printing mode?	Defective #7		Replace #7	
		Defective #3		Replace #3	
		Defective #2		Replace #2	

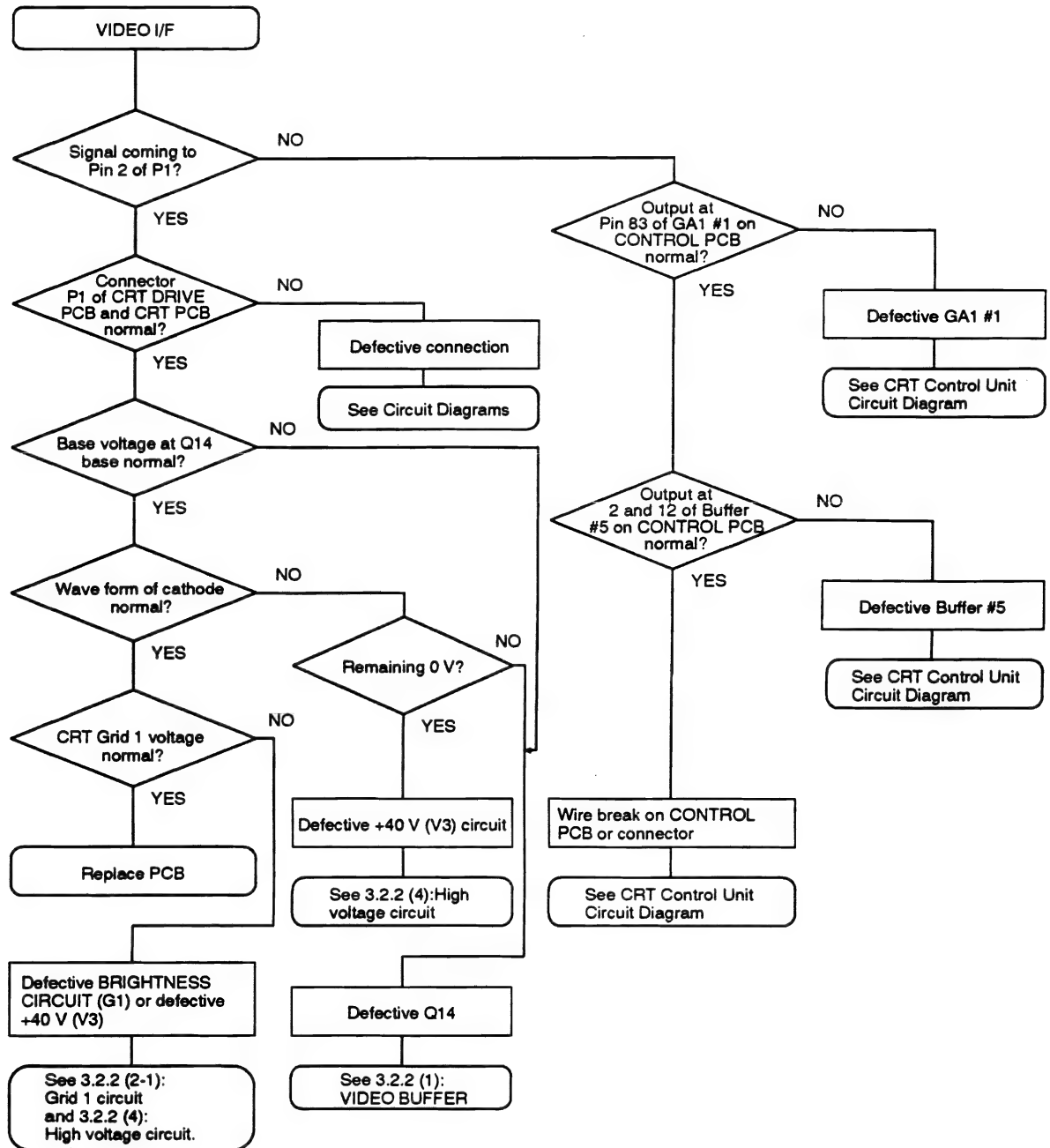
13

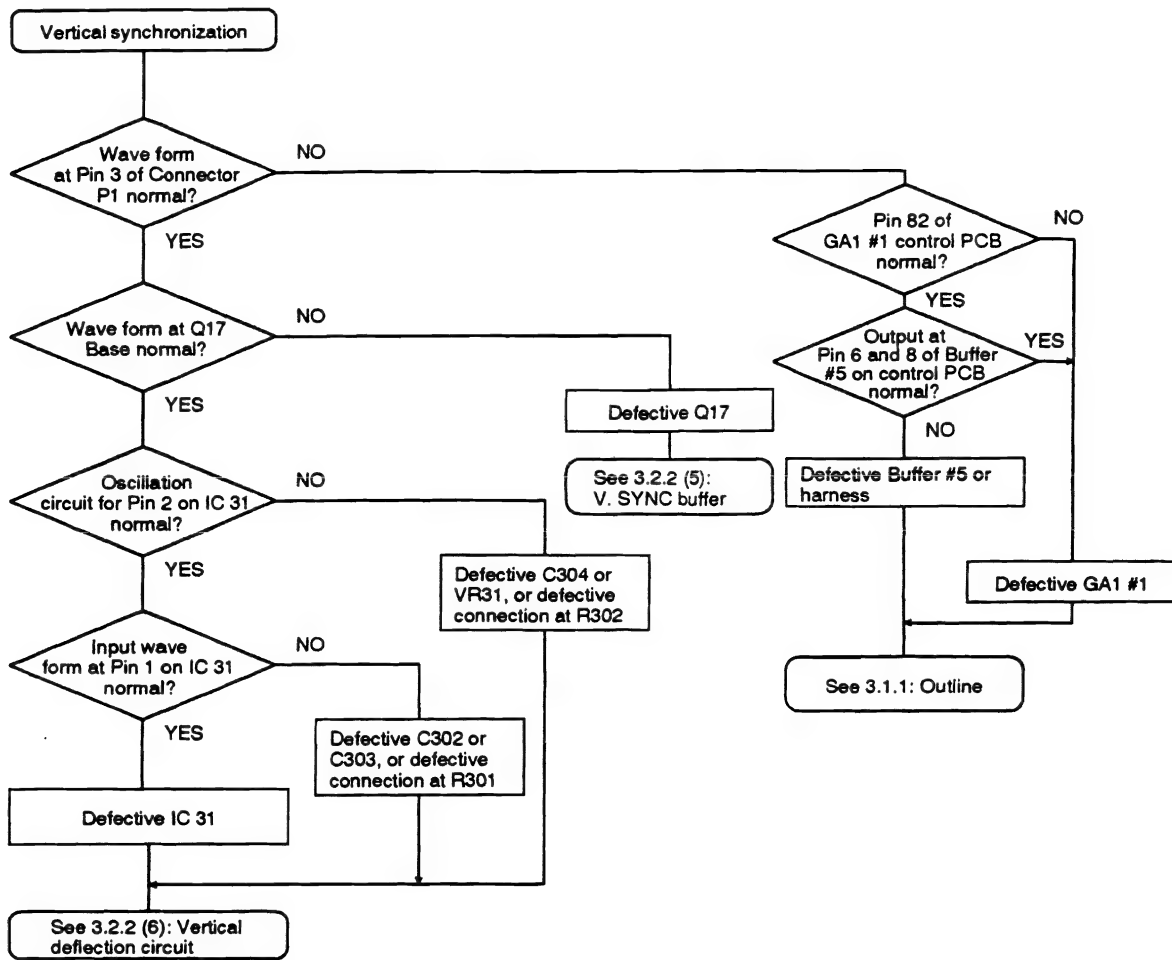
14 CRT does not show a normal display.

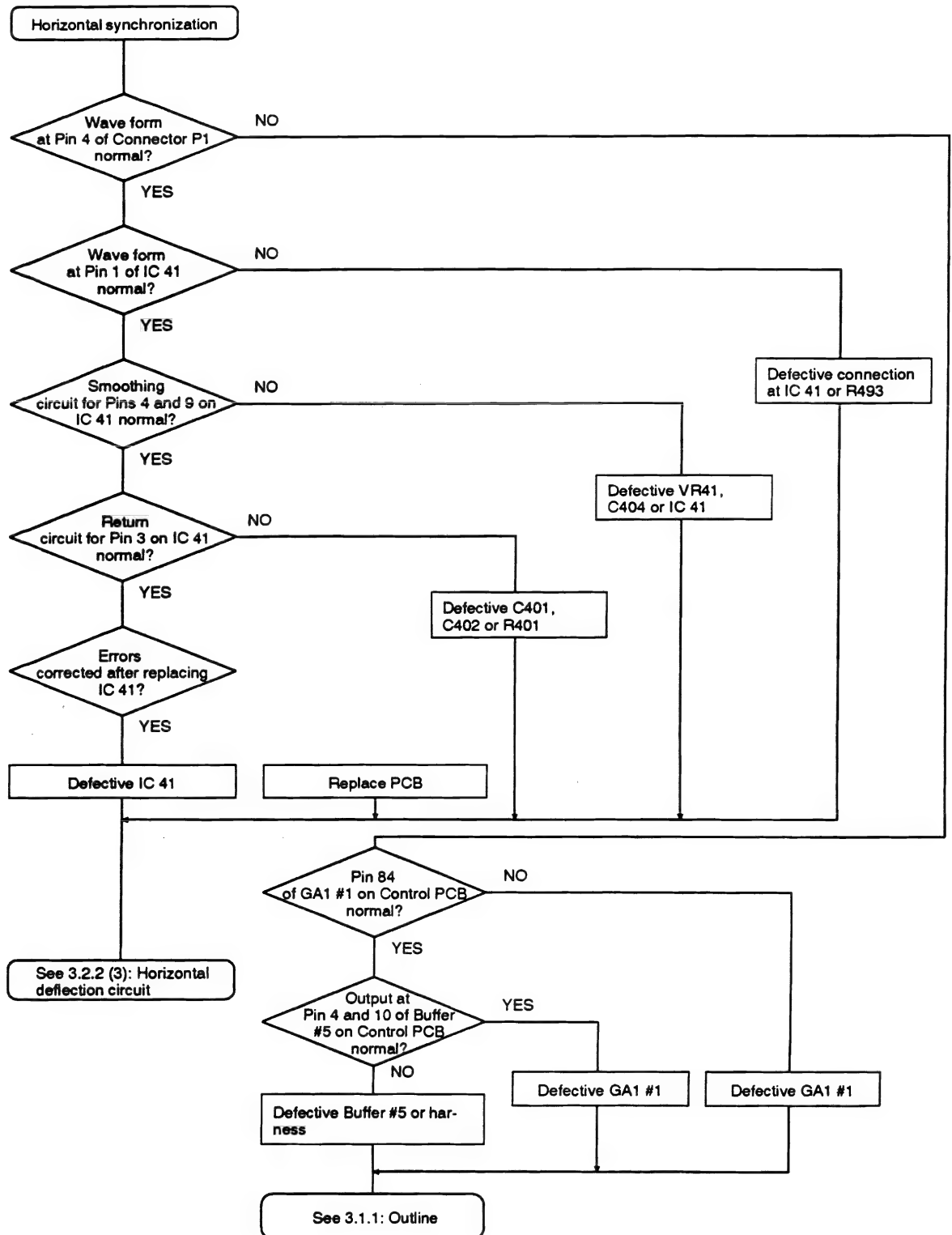
Before starting troubleshooting, clear all the check items in 18.3.3 Adjustments to the CRT, in the Mechanical Section of this Service Manual. Since this trouble may be caused by improper volume adjustment of parts on the CRT PCB, carry out an analysis according to the following flowchart only after verifying the CRT adjustments.

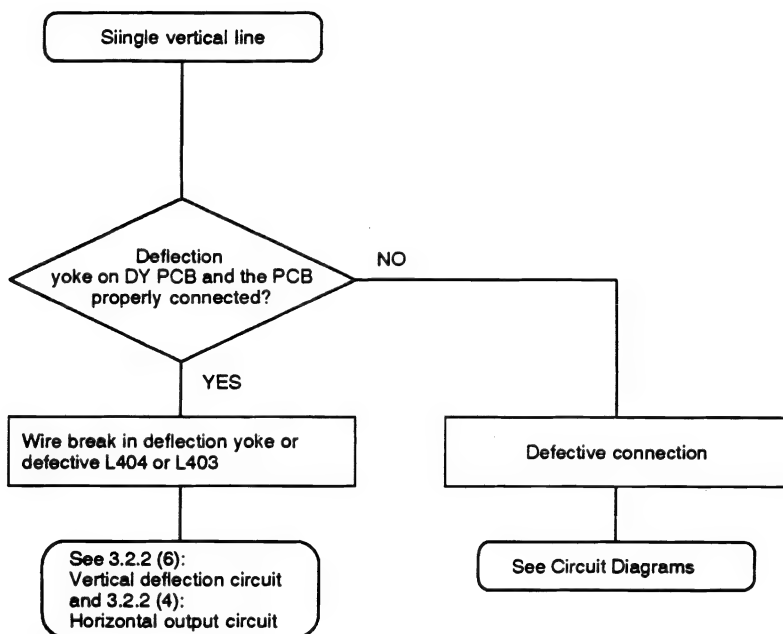
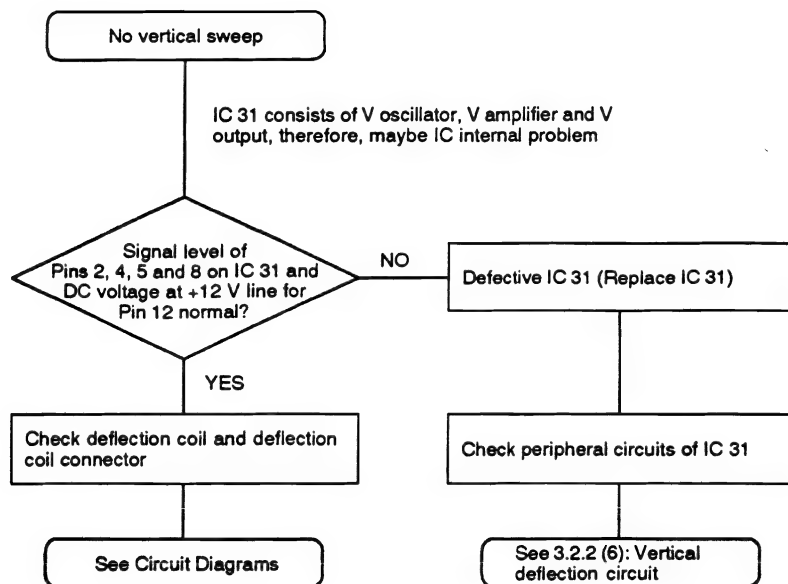


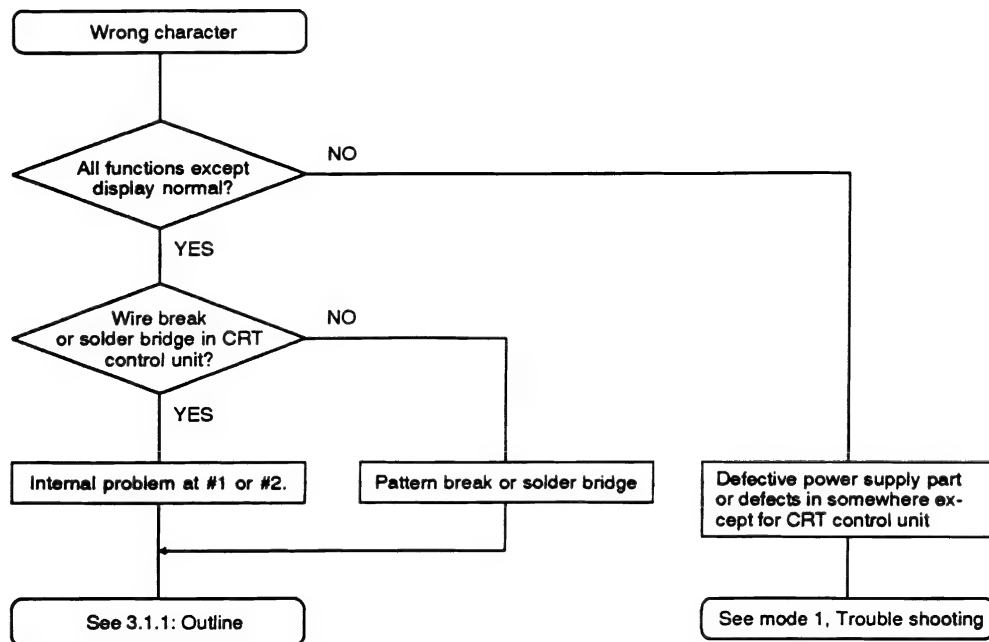












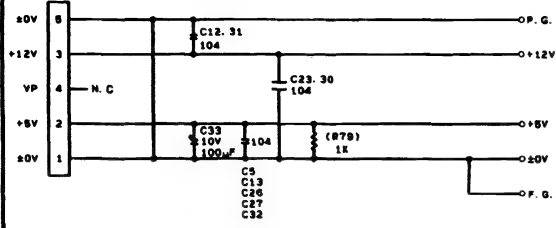
Error Mode	Check Items	Causes	Countermeasures	Repair	Manual
FDD does not operate normally.	Is the card wire (to which the Control PCB and FDD unit are connected) correctly connected?	The card wire is not correctly connected.	Re-connect		4. FDD CONTROL
		The card wire is disconnected.	Take out the card wire and reinstall it correctly.	Replace the card wire.	
	FDD-TEST becomes ERROR. (Since performing this test destroys all data on the disk. Always use a disk containing data which can be sacrificed.)	Defective FDD unit	Take out the card wire and reinstall it correctly.	Replace the FDD unit.	
		Defective FDC #1	Take out the Control PCB and reinstall it correctly.	Replace FDC #1.	

15

1. WITH PULL UP 75Ω
 MARK MEANS IC PIN HAS PULL UP RESISTOR
2. FOR PCB B48J077-1

ROM TYPE	PIN1	PIN31	JW133	JW158
2M PROM	VPP	PROM	X	X
2M MASK ROM	NC	D.C	X	X
4M PROM	VPP	A18	X	X
4M MASK ROM	D.C	A18	X	X
8M MASK ROM	A19	A18	X	X

○ ... 実装 ASSEMBLE
 X ... 実装 NOT ASSEMBLE

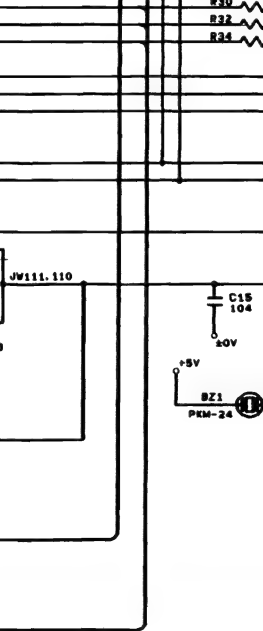
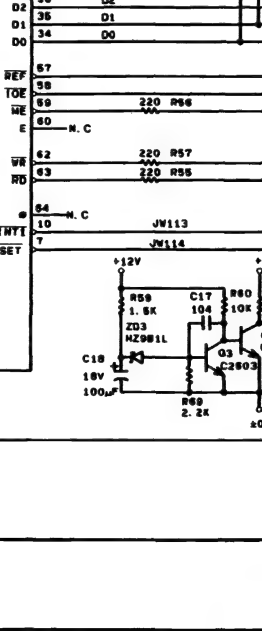
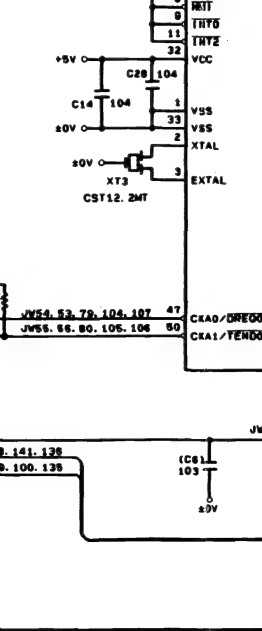
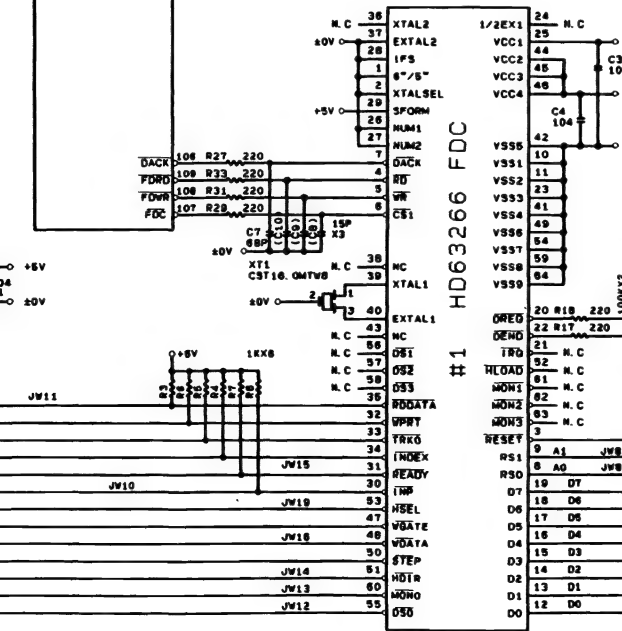
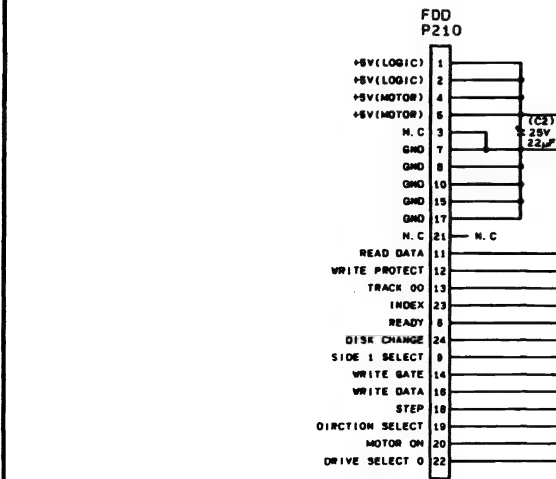
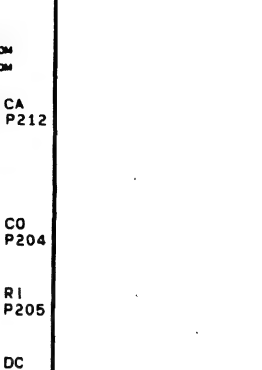
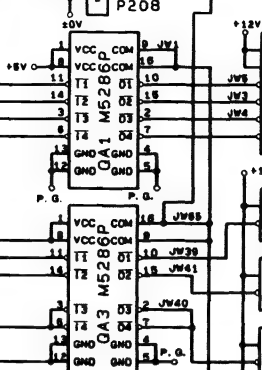
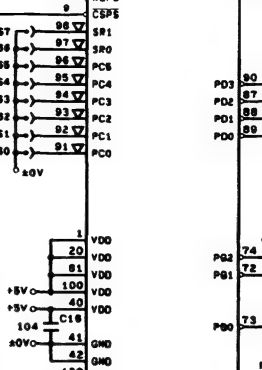
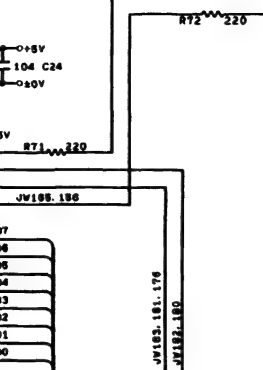
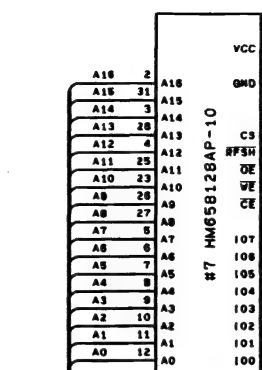
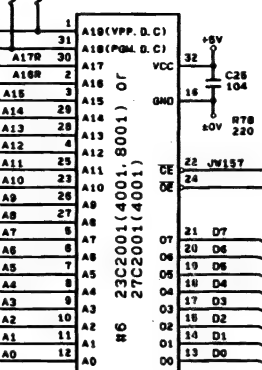
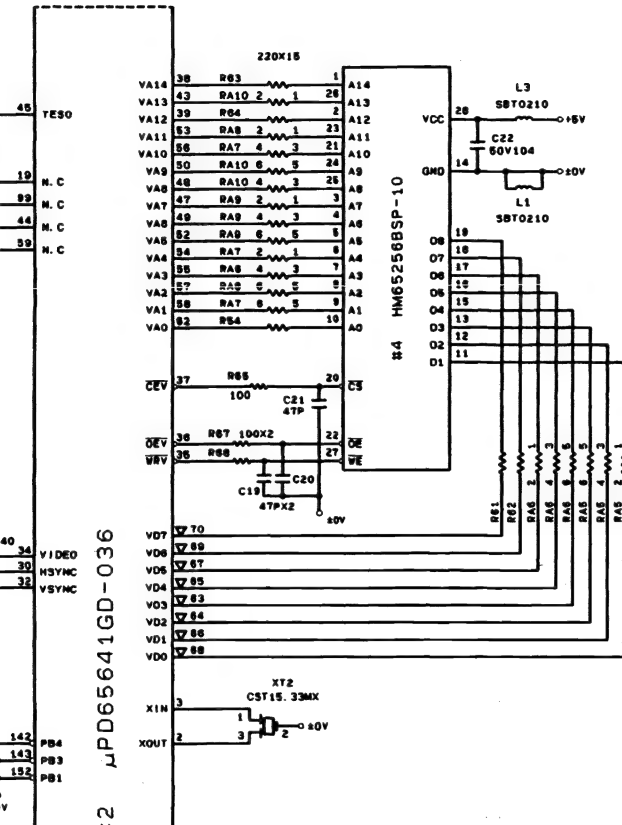
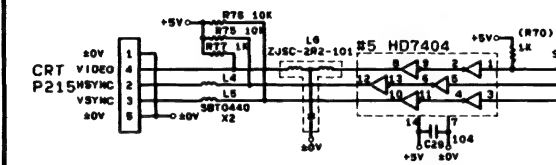


+5V: J2, 9, 20, 22, 23, 30, 31, 32, 34, 36, 38, 44, 46, 47, 48, 49, 50, 60, 64, 66, 68, 69, 71, 72, 75, 77, 78, 85, 87, 91, 93, 94, 96, 98, 99, 101, 103, 115, 116, 122, 124, 128, 129, 132, 134, 139, 146, 147, 148, 149, 154, 158, 161, 162, 167, 168, 170, 172, 178, 186, 187, 188, 192, 193

+5V: J7, 17, 18, 26, 33, 45, 51, 52, 57, 58, 59, 61, 67, 73, 74, 78, 81, 84, 86, 89, 90, 92, 98, 102, 112, 117, 118, 121, 123, 127, 128, 131, 138, 140, 143, 144, 145, 150, 161, 168, 169, 180, 182, 184, 171, 173, 177, 188, 190, 191, 194

(P. 8: 21, 24, 82, 152)

+12V: J25, 26, 42, 83, 70, 126, 130, 137, 142, 153, 155, 158



brother®



WORD PROCESSOR (WP-1 β SERIES)

PARTS REFERENCE LIST

MODEL:WP-2450DS

MECHANICS & ELECTRONICS

NOTES FOR USING THIS PARTS REFERENCE LIST

1. In the case of ordering parts, it needs mentioning the following items:

- (1) Code
- (2) Q'ty
- (3) Description
- (4) Revision No.(for a kind of printed circuit boards)

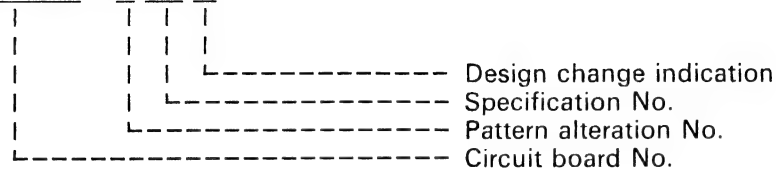
Note: No orders without Parts Code or Tool No. can be accepted.

Example

REF.NO	CODE	O'TY	DESCRIPTION	REMARKS

(4) Revision No.: marked on a printed circuit board

B48V032 - 3 01 A



2. On alternative parts (design changed parts);

They have any one of the following symbols. In such a case, please refer to information, "Technical Information (revised edition)", and order.

- #A : exchangeable
#B : substitutable new one for old
#D : unexchangeable
: newly-established

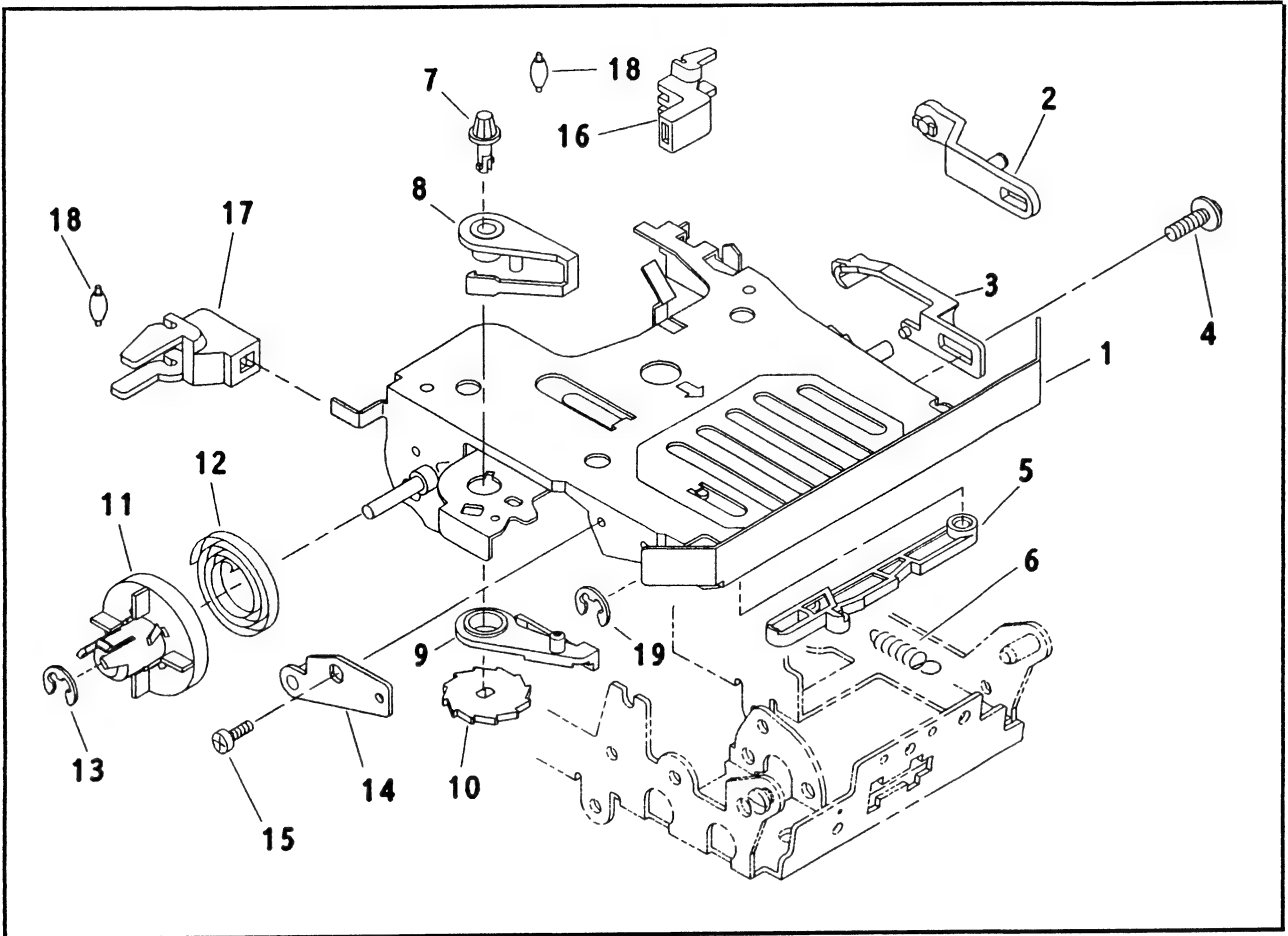
3. The original of this list was made based on the information available in April 1993.

4. Parts are subject to change in design without previous notice.

CONTENTS

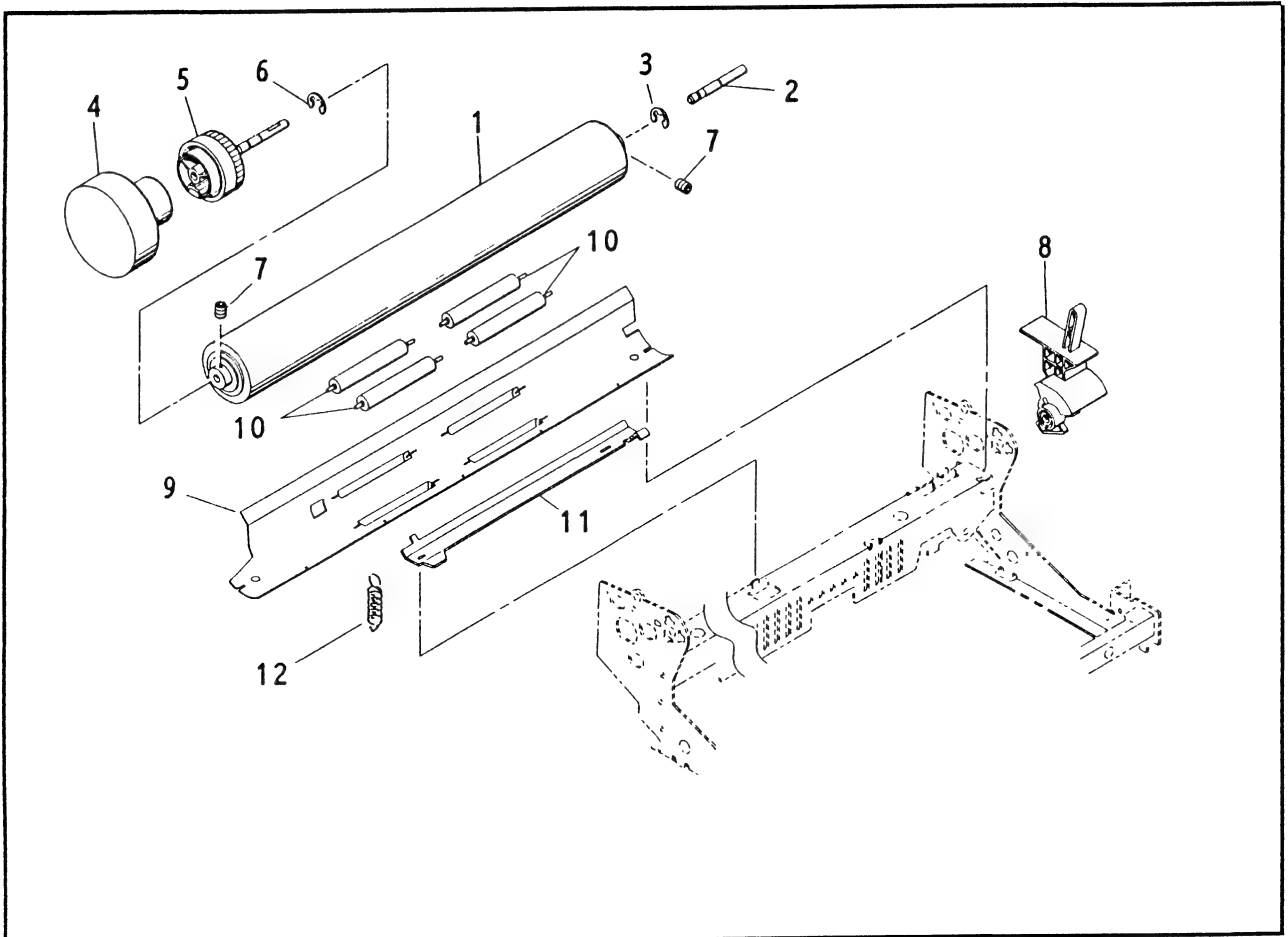
1. RIBBON FEED MECHANISM	1
2. PLATEN MECHANISM	1
3. CARRIER MECHANISM	3
4. TRANSFORMER	5
5. MOTOR	5
6. DETECTOR	7
7. FILTER PCB ASSEMBLY	7
8. POWER SUPPLY PCB ASSEMBLY	9
9. MONITOR	11
10. CHASSIS ATTACHMENT	15
11. FLOPPY DISK DRIVE ASSEMBLY	15
12. COVER	17
13. MAIN PCB ASSEMBLY	19
14. PRINTED MATTER	21
15. PACKING MATERIALS	21
16.1. KEYBOARD MECHANISM/USA.ENGLISH	23
16.2. FUNCTION KEYS/USA.ENGLISH	25
16.3. CHARACTER KEYS/USA.ENGLISH	25
17. ADJUSTING TOOL KIT	27
INDEX	29

1. RIBBON FEED MECHANISM



53V-301-017

2. PLATEN MECHANISM



53V-301-031

1. RIBBON FEED MECHANISM

REF.NO.	CODE	Q'TY	DESCRIPTION	REMARKS
1-18	UA3270002	1	RIBBON VIBRATOR ASSY	
1	UA2218002	1	RIBBON VIBRATOR SUB ASSY RE	
2	U08513001	1	CORRECTION FEED LINK	
3	UA2221001	1	CO WHEEL HOOK	
4	536933001	1	SCREW, PAN (S/P WASHER) M2.6X6	
5	U11209000	1	RIBBON FEED CRANK	
6	UA7645001	1	SPRING, EXTENSION	
7	U08509001	1	RIBBON FEED JOINT	
8	U11211001	1	RIBBON FEED HOOK	
9	U11212000	1	RIBBON FEED RATCHET	
10	U08510001	1	RIBBON FEED RATCHET WHEEL	
11-12	U02720001	1	CS SPINDLE L SPRING ASSY	
11	542302001	1	CO SPOOL SPINDLE L	
12	U02719001	1	SPRING, SPIRAL	
13	048020346	1	RETAINING RING, E2	
14	U11213002	1	CO CAM FOLLOWER SUB ASSY	
15	062300506	1	SCREW, PAN M3X5	
16	UA2222001	1	CORRECTION GUIDE R	
17	U06775001	1	CORRECTION GUIDE L	
18	U06776001	2	CORRECTION GUIDE ROLLER	
19	048030346	1	RETAINING RING, E3	

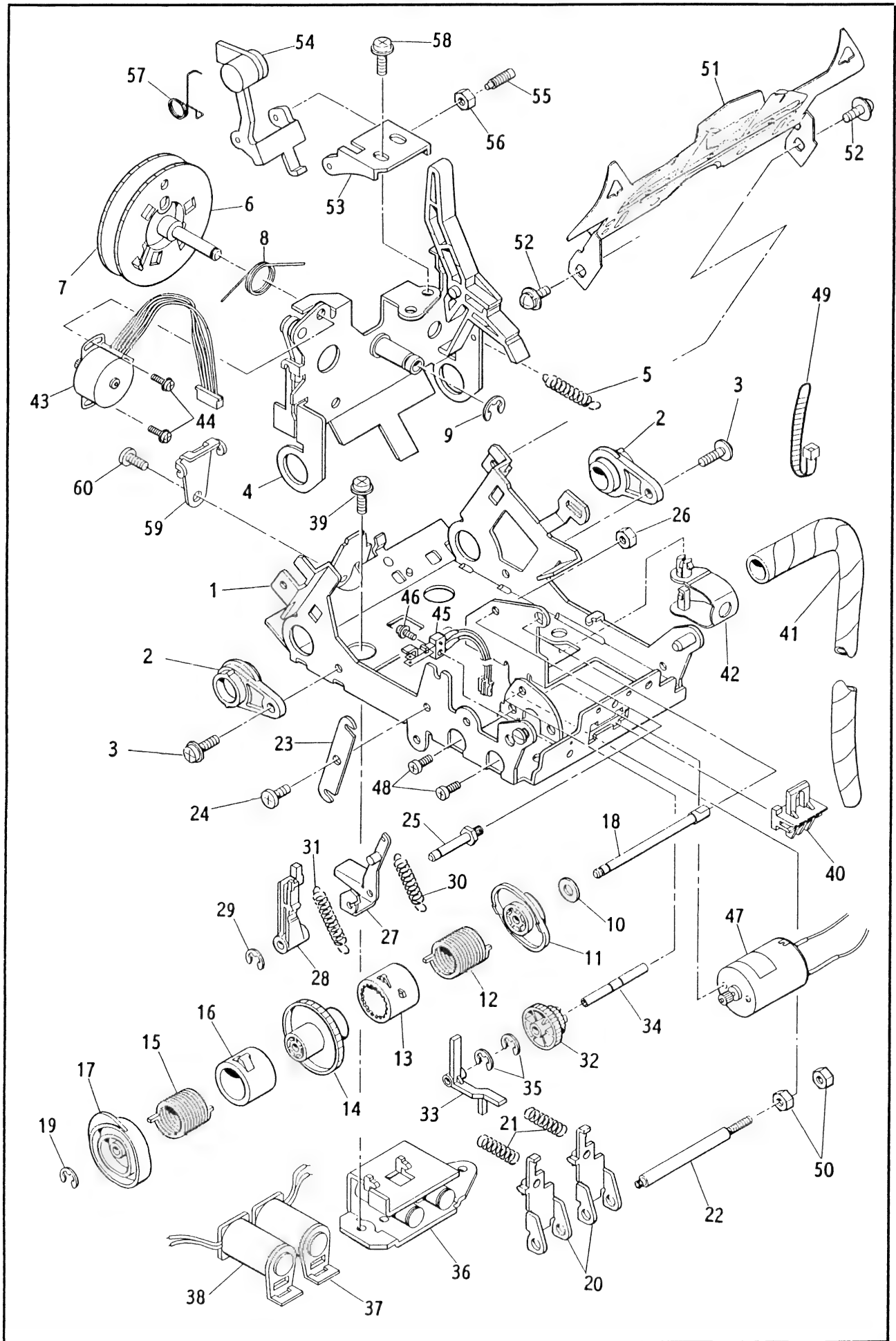
53V-301-017

2. PLATEN MECHANISM

REF.NO.	CODE	Q'TY	DESCRIPTION	REMARKS
1	U11217001	1	PLATEN 12	
2	UA2601001	1	PLATEN SHAFT (R)	
3	048040346	1	RETAINING RING, E4	
4	UA2602021	1	PLATEN KNOB, GRAY1251	
4	UA2602011	1	PLATEN KNOB, GRAY738 WP-2450DS	
5	UA2603001	1	PAPER FEER GEAR ASSY	
6	048040346	1	RETAINING RING, E4	
7	525745001	2	SET SCREW, SOCKET (CP) M4X6W	
8	UA2605021	1	PAPER RELEASE LEVER	
8	UA2605011	1	PAPER RELEASE LEVER, GRAY738 WP-2450DS	
9	UA2606001	1	PAPER PAN ASSY	
10	U05656001	4	PAPER HOLD ROLLER	
11	U11231000	1	PAPER PAN HOLD PLATE	
12	U11232001	1	SPRING, EXTENSION	

53V-301-031

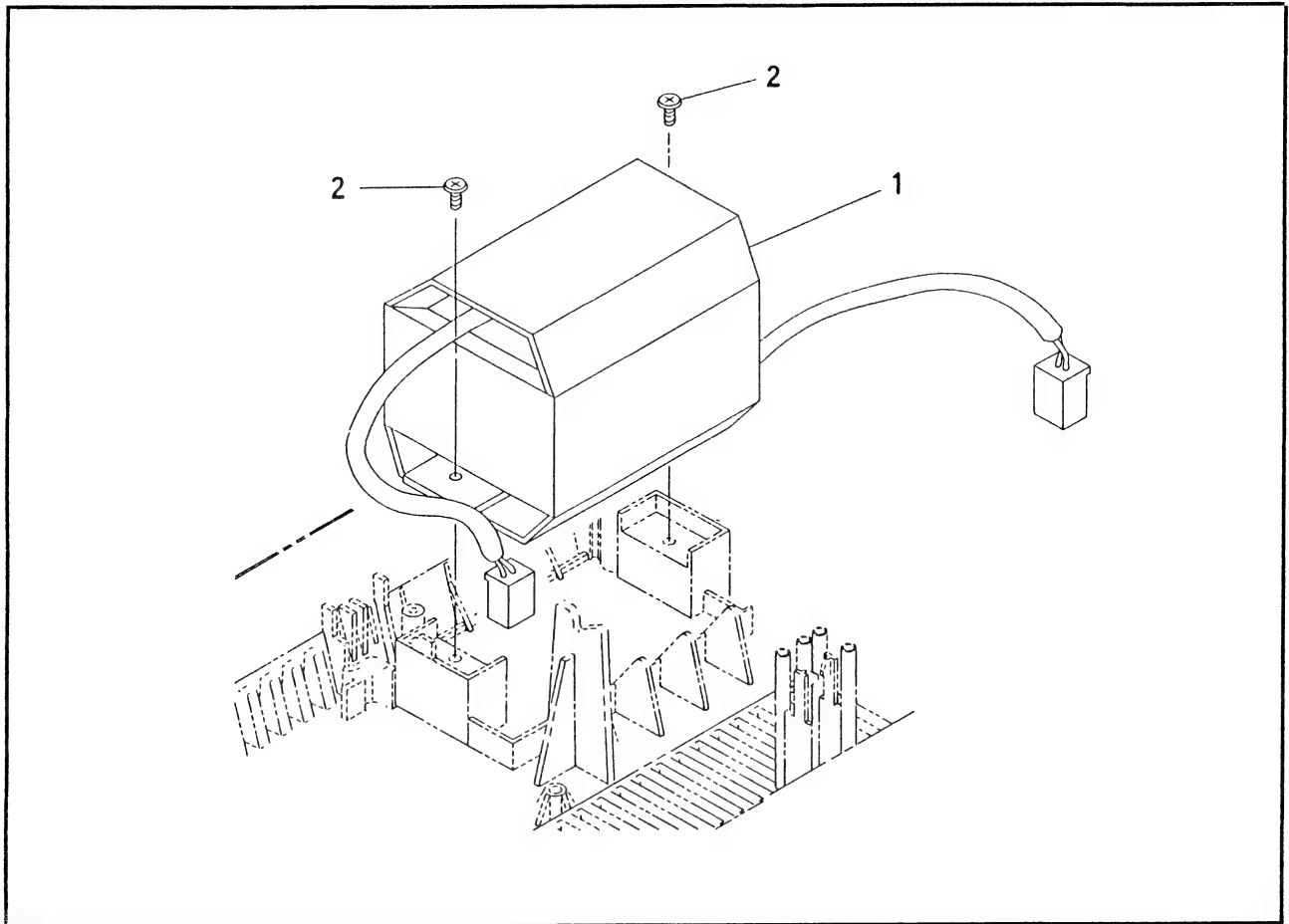
3. CARRIER MECHANISM



3. CARRIER MECHANISM

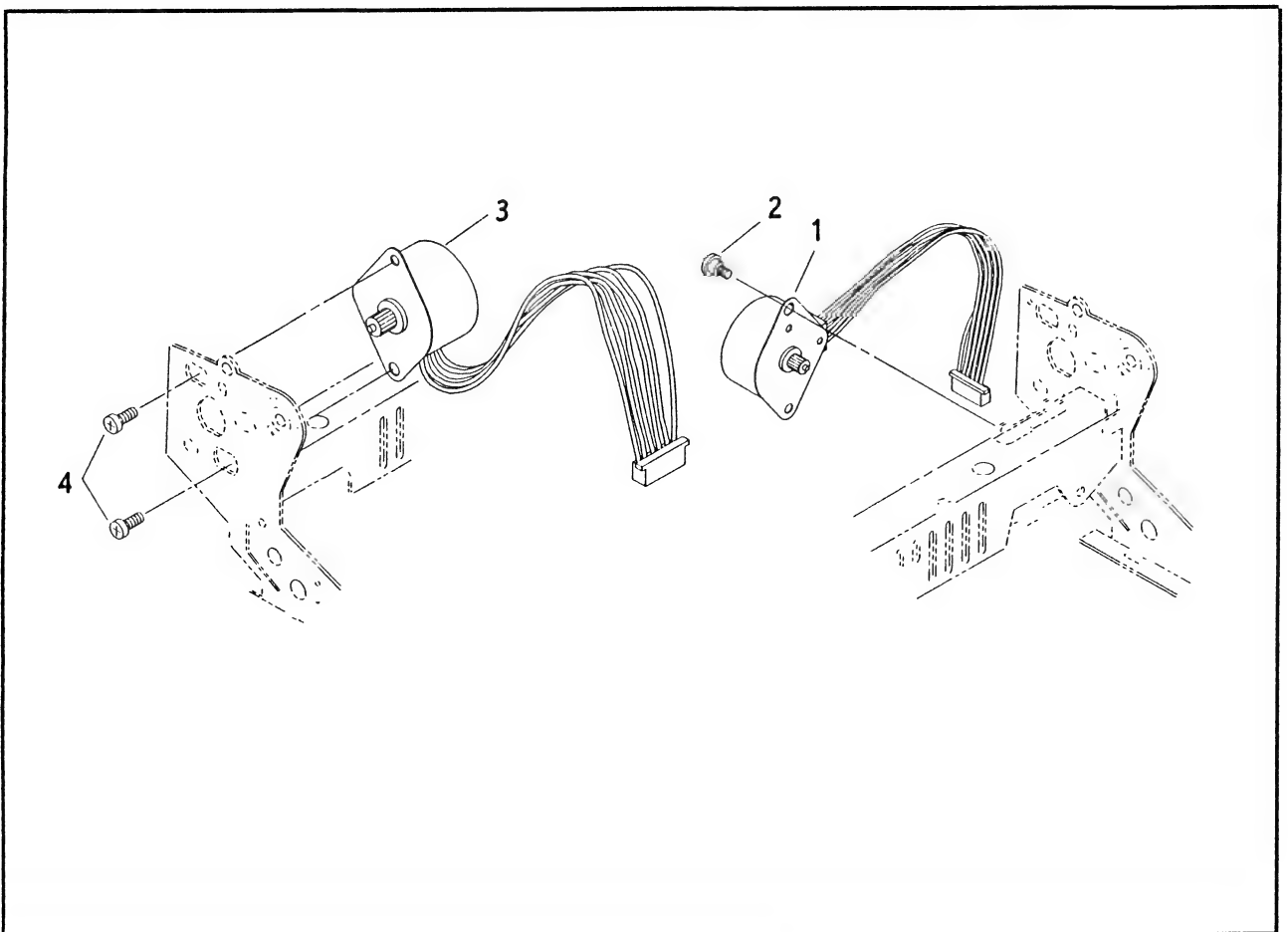
REF.NO.	CODE	Q'TY	DESCRIPTION	REMARKS
1	U11258001	1	HEAD HOLDER SUB ASSY	
2	UA4215000	2	CARRIER RAIL BEARING B	
3	571672001	2	SCREW, FLANGED M3X5	
4	UA2189001	1	MOTOR HOLDER SUB ASSY	
5	U05906001	1	SPRING, EXTENSION	
6	U18552001	1	DAISY WHEEL GEAR	
7	U08858001	1	DAISY WHEEL SUB GEAR	
8	U08629001	1	SPRING	
9	048030346	1	RETAINING RING, E3	
10-19	UA2634001	1	CLUTCH ASSY	
10	026030136	1	WASHER, PLAIN S 3	
11	U11283000	1	HAMMER CAM	
12	U08642001	1	HAMMER CLUTCH SPRING	
13	UA2635001	1	HAMMER CLUTCH COLLAR	
14	U11285000	1	CLUTCH GEAR	
15	U08645001	1	CORRECTION CLUTCH SPRING	
16	U11280001	1	CORRECTION CLUTCH COLLAR	
17	U11286000	1	CORRECTION CAM	
18	U11287001	1	SHAFT	
19	048020346	1	RETAINING RING, E2	
20	UA4224001	2	CLUTCH ARMATURE ASSY B	
21	U02926001	2	SPRING	
22	U18504001	1	SHAFT	
23	U11293000	1	CLUTCH SHAFT CLAMP	
24	062300506	1	SCREW, PAN M3X5	
25	U11294001	1	SHAFT SCREW	
26	021300205	1	NUT, 2 M3	
27	U11295001	1	HAMMER DRIVE CRANK SUB ASSY	
28	U11298000	1	RIBBON OPERATION CRANK	
29	048020346	1	RETAINING RING, E2	
30	U11299001	1	SPRING, EXTENSION	
31	U11300001	1	SPRING, EXTENSION	
32	U11301000	1	CLUTCH GEAR	
33	U11302001	1	CR HOME POSITION CRANK	
34	U11303001	1	SHAFT	
35	048020346	2	RETAINING RING, E2	
36-38	UA4677001	1	HAMMER SOLENOID ASSY	
36	U11804001	1	HAMMER SOLENOID YOKE SUB ASSY	
37	UA2637001	1	HAMMER SOLENOID COIL ASSY	
38	UA2638001	1	CORRECTION SOLENOID COIL ASSY	
39	571672001	2	SCREW, FLANGED M3X5	
40	U11311001	1	HEAD GUIDE	
41	U11313000	1	SPIRAL TUBE	
42	U11314001	1	TUBE HOLDER	
43	UA4786001	1	DAISY WHEEL MOTOR	
44	U11776001	2	SCREW, FLANGED M3X3.5	
45	UA2160001	1	LEAF SWITCH ASSY	
46	U02021001	1	SCREW, FLANGED M2.6X10	
47	UA2643001	1	RIBBON MOTOR ASSY	
48	UA4500001	2	SCREW, PAN M3X3.2	
49	U17807000	2	CABLE TIE	
50	021300205	2	NUT, 2 M3	
51	UA2639001	1	PAPER GUIDE SUB ASSY	
52	U09759001	2	SCREW, PAN (S/P WASHER) M3X6	
53-57	U11274002	1	HAMMER HOLDER ASSY	
53	U08632001	1	HAMMER HOLDER SUB ASSY	
54	U11277001	1	PRINT HAMMER SUB ASSY	
55	U11281001	1	CENTER SCREW	
56	021350206	1	NUT, 2 M3.5	
57	U08637001	1	SPRING	
58	U08671001	2	SCREW, PAN (S/P WASHER) M3X5	
59	U11312000	1	DRIVE WIRE CLAMP	
60	062350605	1	SCREW, PAN M3.5X6	

4. TRANSFORMER



53V-301-050

5. MOTOR



53V-301-054

4. TRANSFORMER

REF.NO.	CODE	Q'TY	DESCRIPTION	REMARKS
1	UA2459000	1	TRANSFORMER, 100V	
1	UA2460000	1	TRANSFORMER, 110V	
1	UA2461000	1	TRANSFORMER, 117V	
1	UA2462000	1	TRANSFORMER, 127V	
1	UA2463000	1	TRANSFORMER, 200V	
1	UA2464000	1	TRANSFORMER, 220V	
1	UA2465000	1	TRANSFORMER, 240V	
1	UA2467000	1	TRANSFORMER, 117V CSA	
2	U08740001	2	TAPTITE, BIND B M4X12	

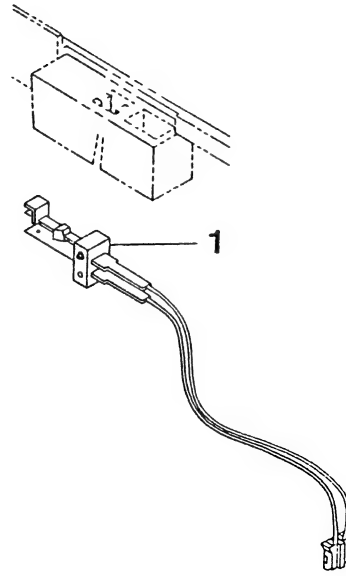
53V-301-050

5. MOTOR

REF.NO.	CODE	Q'TY	DESCRIPTION	REMARKS
1	Z24393001	1	HEAD DRIVE MOTOR	
2	U11776001	2	SCREW, FLANGED M3X3.5	
3	Z24385001	1	PAPER FEED MOTOR	
4	062260406	2	SCREW, PAN M2.6X4	

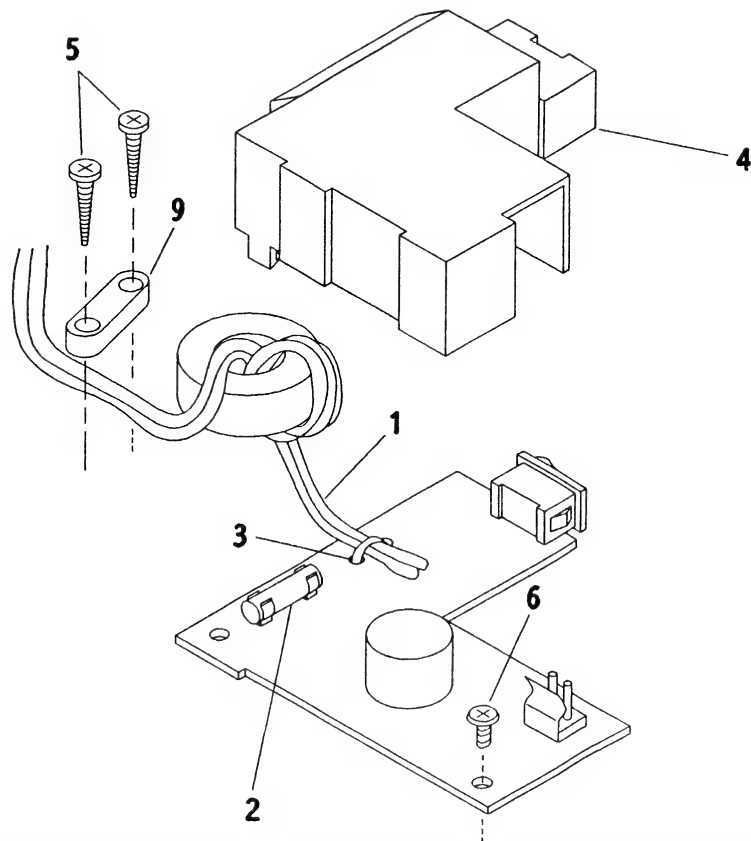
53V-301-054

6. DETECTOR



53V-301-100

7. FILTER PCB ASSEMBLY



53V-301-103

6. DETECTOR

REF.NO.	CODE	Q'TY	DESCRIPTION	REMARKS
1	UA2161001	1	LEAF SWITCH ASSY	

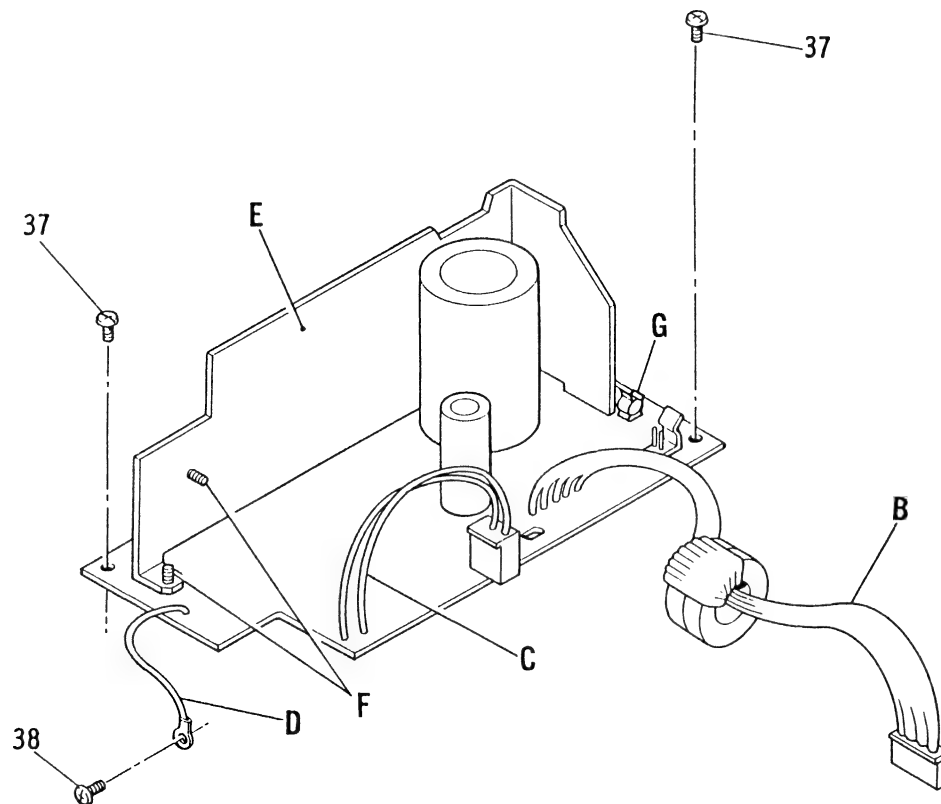
53V-301-100

7. FILTER PCB ASSEMBLY

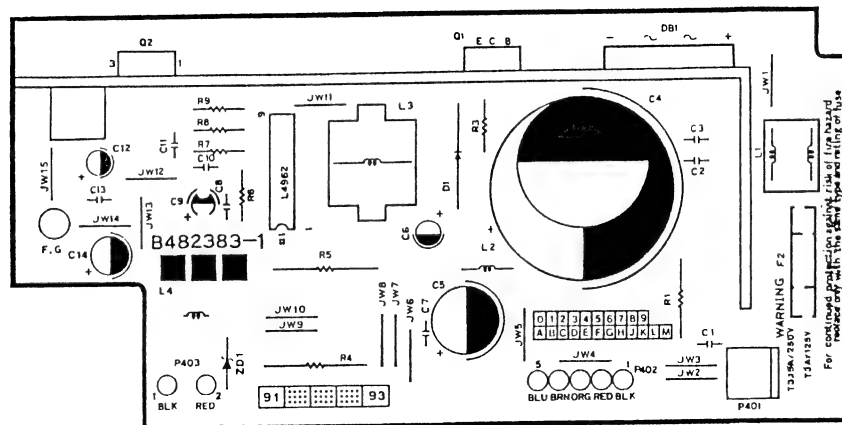
REF.NO.	CODE	Q'TY	DESCRIPTION	REMARKS
1-2	UA1701001	1	FILTER PCB ASSY 1, 100V	
1-2	UA1702001	1	FILTER PCB ASSY 2, 110-120V	
1-2	UA1703001	1	FILTER PCB ASSY 3, 220-230V	
1-2	UA1704001	1	FILTER PCB ASSY 4, 240V	
1-2	UA1705001	1	FILTER PCB ASSY 5, SAA	
1-2	UA1706001	1	FILTER PCB ASSY 6, PERU	
1-2	UA2684001	1	FILTER PCB ASSY 7, 110-120V (SP)	
1-2	UA1708001	1	FILTER PCB ASSY 8, 127V	
1-2	UA1709001	1	FILTER PCB ASSY 9, BS SINGAPORE	
1-2	UA3585001	1	FILTER PCB ASSY 10, FEMKO	
1-2	UA1711001	1	FILTER PCB ASSY 11, BS GBR.	
1	UA2451001	1	AC CORD ASSY, 100V JAPAN	
1	UA2452001	1	AC CORD ASSY, 115V	
1	UA2453001	1	AC CORD ASSY, 220V	
1	UA2454001	1	AC CORD ASSY, BS 240V	
1	UA2455001	1	AC CORD ASSY, SAA	
1	UA2456001	1	AC CORD ASSY, UL 115V	
1	UA5458001	1	AC CORD ASSY, BSM SGP./GBR.	
2	UA2448000	1	GLASS FUSE, 1.6ATSC	
2	UA2449000	1	GLASS FUSE, 1.6A-5TT	
2	UA2450000	1	GLASS FUSE, 800MAS506	
2	UA6348000	1	FUSE, 800MA19181 BS GBR	
3	571852001	1	CORD CLAMP	
4	UA2323008	1	POWER SUPPLY COVER UL/CSA	
4	UA4784001	1	POWER SUPPLY COVER E OTHERS	
5	037301615	2	TAPPING SCREW, PAN V M3X16	
6	U05404001	1	TAPTITE, BIND B M3X8	

53V-301-103

8. POWER SUPPLY PCB ASSEMBLY



1-36

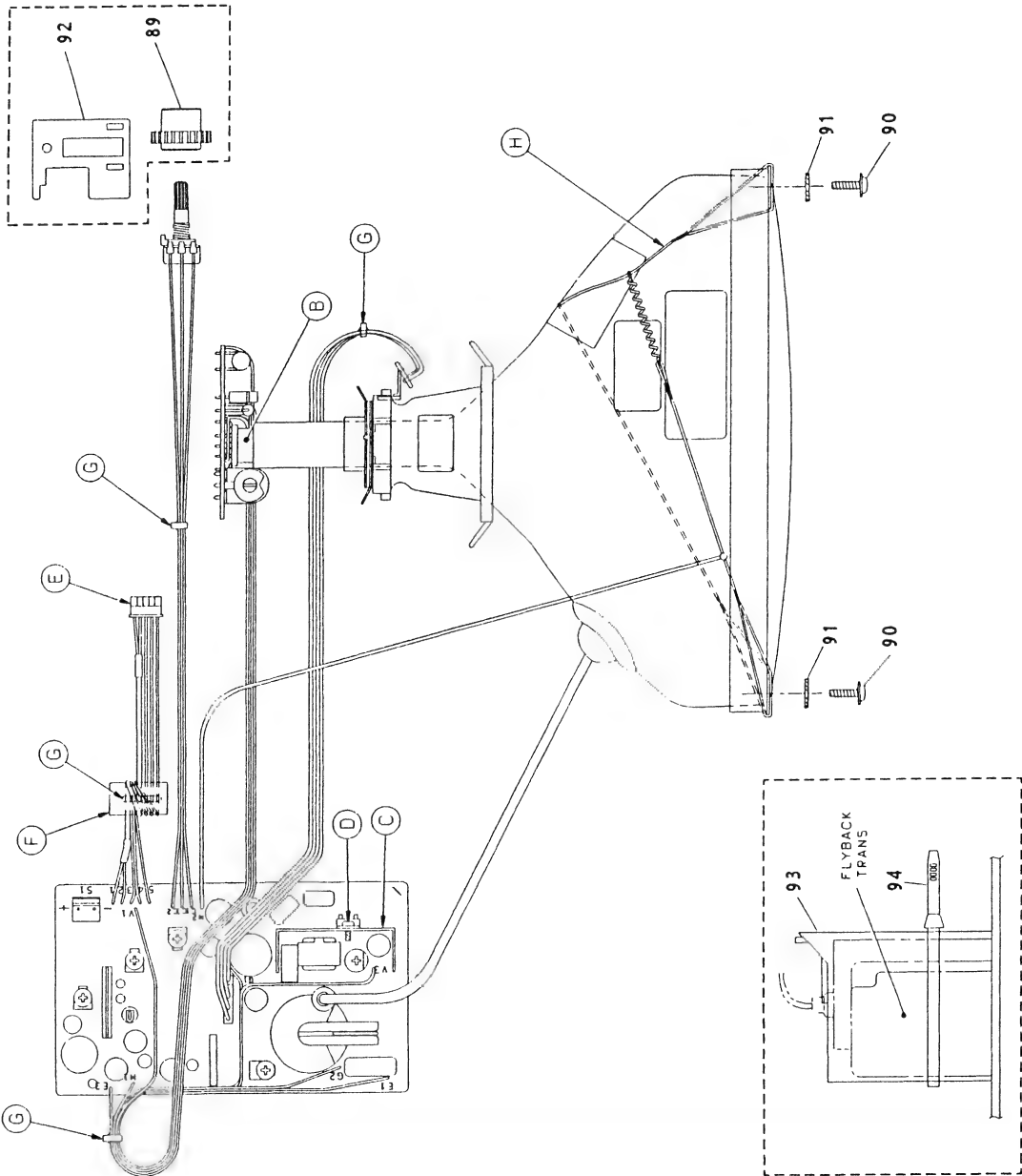
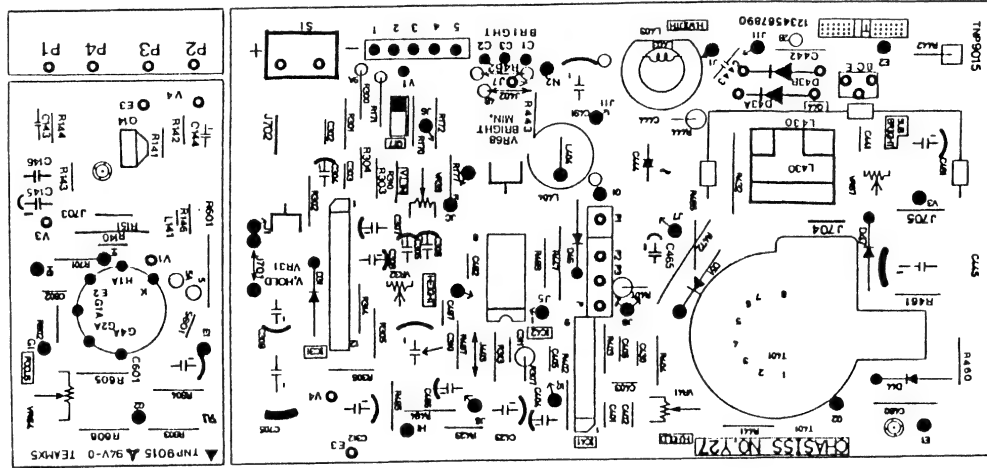


8. POWER SUPPLY PCB ASSEMBLY

REF.NO.	SYMBOL	CODE	Q'TY	DESCRIPTION	RMKS
1-36	B482383-101A	UA2695001	1	PS PCB ASSY 1, 100-127V (SP)	
1-36	B482383-102	UA6213001	1	PS PCB ASSY 2, 200-240V	
1	#1	U85273000	1	IC:L4962	
2	Q2	136345001	1	REGULATOR:7805	
3	DB1	U17798000	1	DIODE, BR:D3SBA10	
4	Q1	UA6203000	1	TRANSISTOR, :2SC4150	
5	D1	UA6204000	1	DIODE, :SB360	
6	L1	U16735000	1	COIL:PLT1R53C	
7	L3	UC1314000	1	CHOKE COIL:140UH-3A	
8	L2	U32795001	1	FERRITE BEAD:BL01A	
9	L4	UA6205000	1	COIL:FL9H680K	
10	ZD1	UA6206000	1	DIODE, ZENER:MTZ15C	
11	C10	U18073000	1	CAPACITOR, CERAMIC 25SR333-249	
12	C7,13	U10389000	2	CAPACITOR, CERAMIC 25B104Z-249	
13	C11	Y21010001	1	CAPACITOR, CERAMIC 50B101	
14	C8	U18072000	1	CAPACITOR, CERAMIC 50B332-249	
15	C1,2,3	U10435000	3	CAPACITOR, CERAMIC 50B104-249	
16	C12	Y41011601	1	CAPACITOR, ALUM-ELEC 10B101	
17	C9	Y41002002	1	CAPACITOR, ALUM-ELEC 16B100	
18	C14	U18267000	1	CAPACITOR, ALUM-ELEC 16B101	
19	C5	Y42222001	1	CAPACITOR, ALUM-ELEC 16B222	
20	C6	Y41005602	1	CAPACITOR, ALUM-ELEC 50B100VS	
21	C4	UA1822000	1	CAPACITOR, ALUM-ELEC 50B682	
22	R9	090751110	1	FIXED RESISTOR, D-A14YG751R25	
23	R8	090561110	1	FIXED RESISTOR, D-A14YG561R25	
24	R3	Y01009411	1	FIXED RESISTOR, G-A12YJ100	
25	R7	090153120	1	FIXED RESISTOR, D-A14YJ153	
26	R6	090332120	1	FIXED RESISTOR, D-A14YJ332	
27	R4,5	UA6207000	2	FIXED RESISTOR, G-A3YJ20-1	
28	R1	U15635001	1	FIXED RESISTOR, G-A2YJ152	
29	P401	U18078000	1	CONNECTOR:5273-02A	
30	P402(B)	UA6208001	1	POWER SUPPLY HARNESS ASSY	
31	P403(C)	UA1819001	1	CRT HARNESS ASSY	
32	F,G(D)	UA1820000	1	GROUND WIRE #1	
33	E	UA6210000	1	HEAT SINK #1	
34	F	U06923001	4	TAPTITE, BIND B M3X10	
35	F2	UC1840000	1	GLASS FUSE, 3A-5TT	
35	F2	U17813000	1	GLASS FUSE, 3.15AS506	
36	G	U16537000	2	FUSE CRIP:S-N5057S	
37		U05404001	2	TAPTITE, BIND B M3X8	
38		062300506	1	SCREW, PAN M3X5	

9. MONITOR

1-88



1-88A

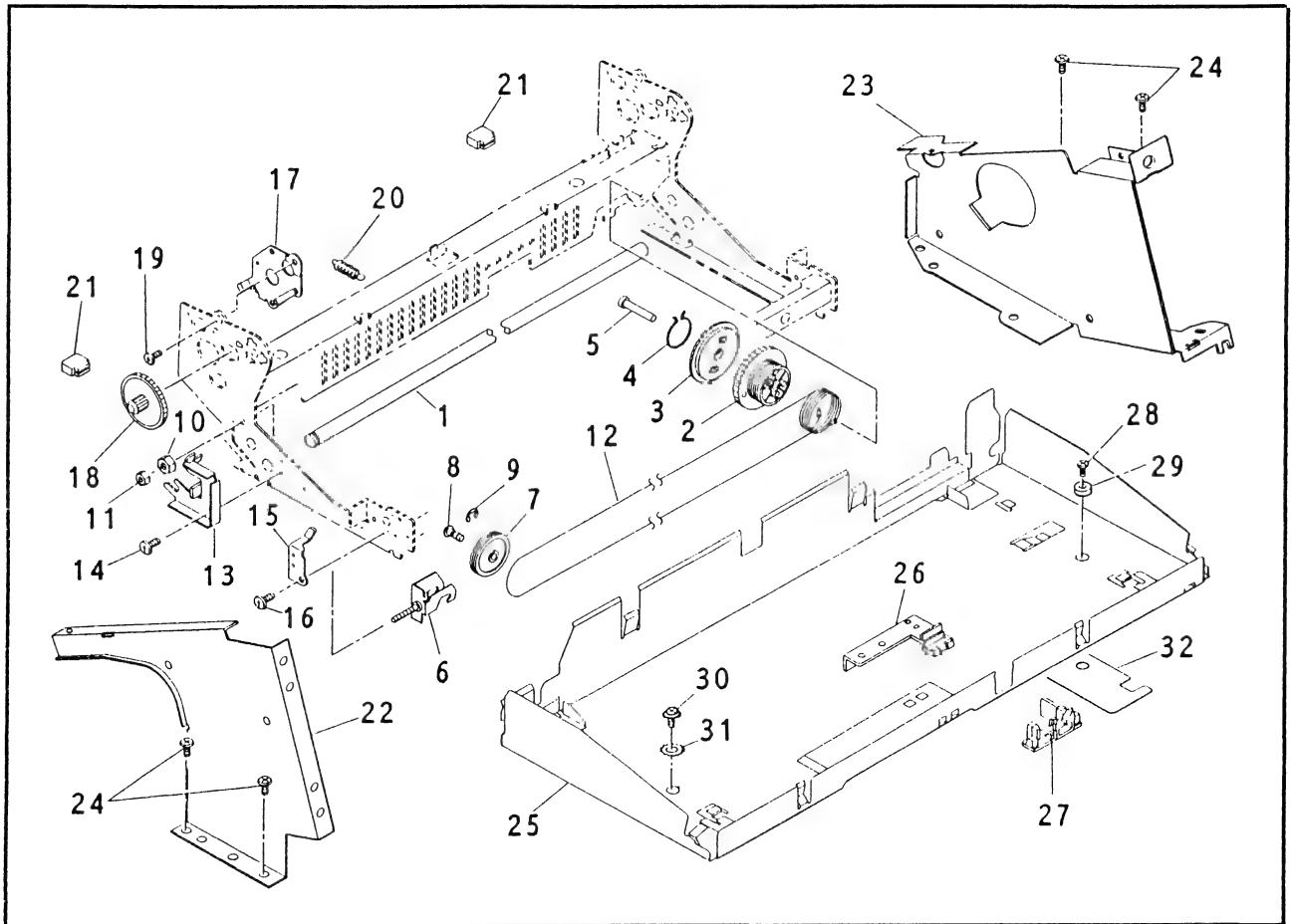
9. MONITOR

REF.NO.	SYMBOL	CODE	Q'TY	DESCRIPTION	RMKS
1-88A		UA2658001	1	CRT UNIT (SP) NORTHERN HEMISPHERE	
1-88A		UA1683001	1	CRT UNIT CTC-S SOUTHERN HEMISPHERE	
1-88	TNP9015	UA2666001	1	CRT PCB ASSY (SP)	
1	IC31	U78389000	1	IC:AN5763	
2	IC41	U78388000	1	IC:AN5753	
3	Q14	U78328000	1	TRANSISTOR, :2SC1360ANC	
4	Q17	U78330000	1	TRANSISTOR, :2SD636QR	
5	Q44	UC0104000	1	TRANSISTOR, :2SD1163A02	
6	D44	UA2428000	1	DIODE, :RGP01-14	
7	D46,51	UC0109000	2	DIODE, :TVR06J	
8	D43A,43B	UC0141000	2	DIODE, :TVR10J	
9	D47	U78547000	1	DIODE, :TVR06D	
10	D31	U78326000	1	DIODE, :10E1FC	
11	L141	U78369000	1	COIL:TLT047K991	
12	L403	UA2429000	1	COIL:TLH80707T-1D	
13	L404	U78367000	1	COIL:TLH80619T	
14	L430	U78366000	1	TRANSFORMER:TLH80410	
15	C143	Y13912000	1	CAPACITOR, CERAMIC 50B391	
16	C602	UC0281000	1	CAPACITOR, CERAMIC 500B102	
17	C308	Y43300001	1	CAPACITOR, ALUM-ELEC 6.3B330	
18	C310	Y41021001	1	CAPACITOR, ALUM-ELEC 10B102	
19	C307	Y41002001	1	CAPACITOR, ALUM-ELEC 16B100	
20	C309	Y42212001	1	CAPASITOR, ALUM-ELEC 16B221	
21	C423	Y43312001	1	CAPACITOR, ALUM-ELEC 16B331	
22	C312	Y44712001	1	CAPACITOR, ALUM-ELEC 16B471	
23	C491	Y41022001	1	CAPACITOR, ALUM-ELEC 16B102	
24	C705	Y42222001	1	CAPACITOR, ALUM-ELEC 16B222	
25	C404	Y44793001	1	CAPACITOR, ALUM-ELEC 25B47-1	
26	C145	Y41006001	1	CAPACITOR, ALUM-ELEC 63B100	
27	C461	Y41016001	1	CAPACITOR, ALUM-ELEC 63B101	
28	C465	U78391000	1	CAPACITOR, ALUM-ELEC 350B33-1	
29	C406	Y51020000	1	CAPACITOR, POLYESTER 50B102	
30	C303,403	Y51030000	2	CAPACITOR, POLYESTER 50B103	
31	C402,430	Y51530000	2	CAPACITOR, POLYESTER 50B153	
32	C401	Y51830000	1	CAPACITOR, POLYESTER 50B183	
33	C302	Y52230000	1	CAPACITOR, POLYESTER 50B223	
34	C311	Y53330000	1	CAPACITOR, POLYESTER 50B333	
35	C443	UA2442000	1	CAPACITOR, POLYESTER 400B223	
36	C442	UA2443000	1	CAPACITOR, POLYESTER 400B333	
37	C460	UA2430000	1	CAPACITOR, POLYESTER 1000B104	
38	C305,306	U78383000	2	CAPACITOR, TANTALUM 16B47-1	
39	C304	U78384000	1	CAPACITOR, TANTALUM 35B33-2	
40	C444	U78392000	1	CAPACITOR, ALUM-ELEC 25B120	
41	C405	UA2431000	1	CAPACITOR, STYROL 125B392	
42	R444	090122620	1	FIXED RESISTOR, D-A14AJ122S	
43	R307	090479120	1	FIXED RESISTOR, D-A14YJ47-1	
44	R143	090470120	1	FIXED RESISTOR, D-A14YJ470	
45	R146	090820120	1	FIXED RESISTOR, D-A14YJ820	
46	R144	090101120	1	FIXED RESISTOR, D-A14YJ101	
47	R313	090221120	1	FIXED RESISTOR, D-A14YJ221	
48	R140	090202120	1	FIXED RESISTOR, D-A14YJ202	
49	R404	090242120	1	FIXED RESISTOR, D-A14YJ242R25	
50	R402	090332120	1	FIXED RESISTOR, D-A14YJ332	
51	R301	090472120	1	FIXED RESISTOR, D-A14YJ472	
52	R172	090562120	1	FIXED RESISTOR, D-A14YJ562	
53	R493	090682120	1	FIXED RESISTOR, D-A14YJ682	
54	R170,171	090103120	2	FIXED RESISTOR, D-A14YJ103	
55	R310	090153120	1	FIXED RESISTOR, D-A14YJ153	
56	R462	090183120	1	FIXED RESISTOR, D-A14YJ183	
57	R403	090273120	1	FIXED RESISTOR, D-A14YJ273	
58	R401	090333120	1	FIXED RESISTOR, D-A14YJ333	
59	R302	090683120	1	FIXED RESISTOR, D-A14YJ683	
60	R305	090144120	1	FIXED RESISTOR, D-A14YJ144	
61	R465	090474120	1	FIXED RESISTOR, D-A14YJ474	
62	R304,306	U78398000	2	FIXED RESISTOR, D-A14AJ11-1	
63	R303,441,461	U78352000	3	FIXED RESISTOR, D-A14AJ68-1	
64	R460	UA2432000	1	FIXED RESISTOR, D-A14AJ220	
65	R423	U78353000	1	FIXED RESISTOR, D-A14AJ680	
66	R443	U78351000	1	FIXED RESISTOR, D-A14AJ122	
67	R602,605,606	U78350000	3	FIXED RESISTOR, D-A14AJ103	
68	R601	U78397000	1	FIXED RESISTOR, S-A12AK561	
69	R447	Y06800510	1	FIXED RESISTOR, G-A1AJ681	
70	R151	Y01801711	1	FIXED RESISTOR, G-A3YJ182	
71	R432	U78354000	1	FIXED RESISTOR, M-A2J100	
72	VR41	UA7724000	1	VARIABLE RESISTOR, D-1RLB102	
73	VR33,68	UA7723000	2	VARIABLE RESISTOR, D-1RLB103	
74	VR32	UA7722000	1	VARIABLE RESISTOR, D-1RLB503	
75	VR31	UA7721000	1	VARIABLE RESISTOR, D-1RLB104	
76	VR63	UA2446000	1	VARIABLE RESISTOR, D-1ROB104	
77	VR67	U78356000	1	VARIABLE RESISTOR, D-1RLB204	
78	VR64	U78357000	1	VARIABLE RESISTOR, D-1RLB205	
79	T401	U78365000	1	FB TRANSFORMER:TLF80337T-1	
80	S1	U16194000	1	CONNECTOR:5289-2A	

9. MONITOR

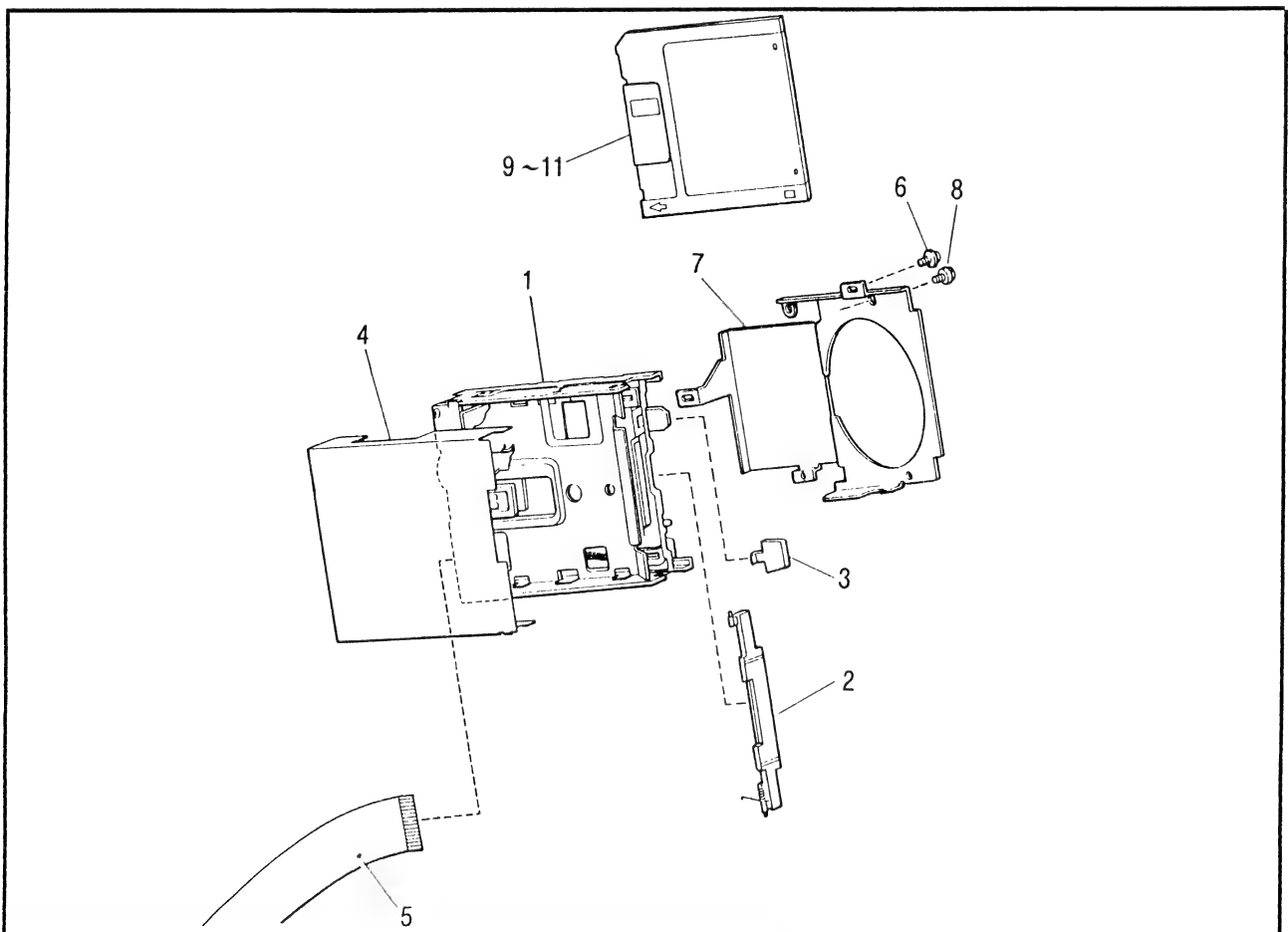
REF.NO.	SYMBOL	CODE	Q'TY	DESCRIPTION	RMKS
81	B	UC0113000	1	CRT SOCKET	
82	C	UA2434000	1	HEAT SINK:TUC4C0025	
83	D	535151001	1	SCREW, PAN 2 M3X8	
84-86	O	UA3537001	1	SIGNAL CABLE UNIT	
84	E	UA3538001	1	SIGNAL CABLE ASSY	
85	F	UA2447000	1	FILTER B5T, 25.9X14	
86	G	529545001	1	CABLE TIE	
87	G	529545001	4	CABLE TIE	
88	H	UA2437001	1	KNIT WIRE:TXA3A19015	
89		UA2321021	1	BLIGHTNESS CONTROLLER GRAY1251	
89		UA2321022	1	BLIGHTNESS CONTROLLER GRAY1252	
89		UA2321015	1	BLIGHTNESS CONTROLLER GRAY1135	
89		UA2321011	1	BLIGHTNESS CONTROLLER GRAY738,WP-2450DS	
90		U02082001	4	TAPPING SCREW, FLANGE 2 M4X12	
91		502673001	4	WASHER, EX TOOTH 4	
92		UA2322000	1	VOLUME HOLDER	

10. CHASSIS ATTACHMENT



53V-311-034

11. FLOPPY DISK DRIVE ASSEMBLY



53V-311-302

10. CHASSIS ATTACHMENT

REF.NO.	CODE	Q'TY	DESCRIPTION	REMARKS
1	U11242001	1	HEAD GUIDE SHAFT	
2-4	UA2619001	1	HEAD DRIVE PULLEY ASSY	
2	UA2620000	1	HEAD DRIVE PULLEY MAIN	
3	UA2621000	1	HEAD DRIVE PULLEY SUB	
4	UA2622000	1	HEAD DRIVE PULLEY SPRING	
5	U08575001	1	SHOULDER STUD	
6	U11244001	1	TENSION PULLEY HOLDER SUB ASSY	
7-9	U11246001	1	HEAD TENSION PULLEY ASSY	
7	U06824001	1	HEAD TENSION PULLEY	
8	U11247001	1	SHAFT	
9	048030346	1	RETAINING RING, E3	
10	U06958001	1	NUT, M3.5	
11	021350106	1	NUT, 1 M3.5	
12	U11248001	1	DRIVE WIRE ASSY	
13	UA2623000	1	PW HOME POSITION ACTUATOR	
14	062300506	1	SCREW, PAN M3X5	
15	U11251000	1	CR HOME POSITION LEVER	
16	062300506	1	SCREW, PAN M3X5	
17	UA2617001	1	P FEED MOTOR HOLDER SUB ASSY	
18	UA2325000	1	PAPER FEED IDLE GEAR	
19	U11256001	1	SHOULDER SCREW	
20	U11500001	1	SPRING, EXTENSION	
21	UA2624001	2	CHASSIS SUPPORT	
22	UA2625000	1	SUB CHASSIS	
23	UA7369000	1	FDD HOLDER	
24	U08740001	4	TAPTITE, BIND B M4X12	
25	UA2628000	1	SHIELD PLATE	
26	UA2629008	1	CABLE CLAMP	
27	UA2630008	1	CORD CLAMP	
28	UA2202001	1	TAPTITE, CUP M3.5X6	
29	UA2159000	1	COLLAR	
30	519475002	1	SCREW, FLANGED M3.5X6	
31	502673001	1	WASHER, EX TOOTH 4	
32	UA2200001	1	INSULATOR	

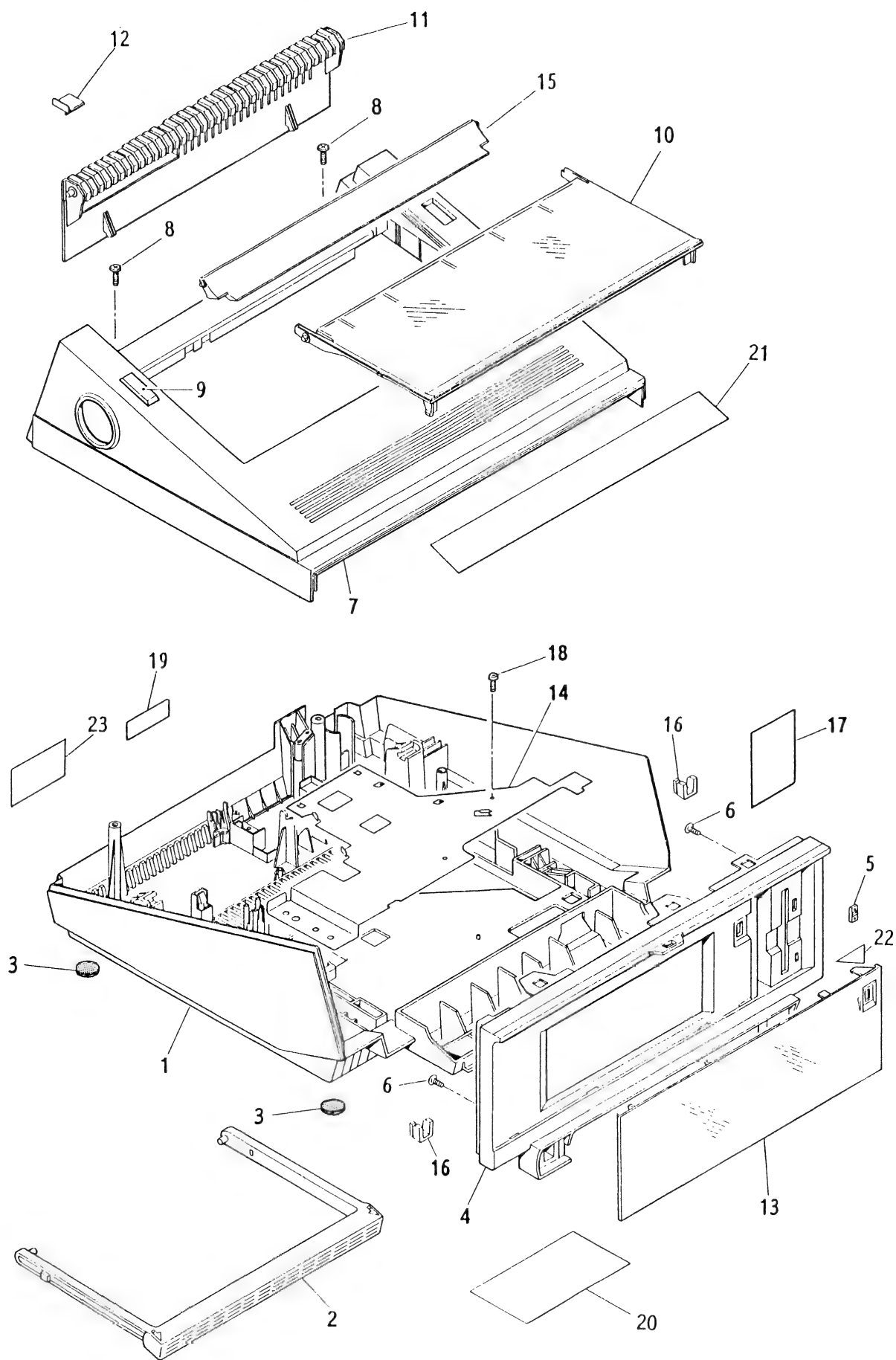
53V-311-034

11. FLOPPY DISK DRIVE ASSEMBLY

REF.NO.	CODE	Q'TY	DESCRIPTION	REMARKS
1	UA8735011	1	FDD:D357T3B (SP) GRAY738 (WITH 2-4)	
2	UA8705011	1	CHASSIS SHUTTER BR GRAY738	
3	UA8706011	1	EJECT BUTTON BR GRAY738	
4	UA8718000	1	SHIELD CASE B	
5	UA7524001	1	FLAT CABLE	
6	U09759001	3	SCREW, PAN (S/P WASHER) M3X6	
7	UA8717000	1	FDD SUB HOLDER	
8	U11776001	3	SCREW, FLANGED M3X3.5	
9	UA8719001	1	2DD DISK ASSY WP-2450DS	
10	UA8721001	1	2DD DISK ASSY	
11	UA8723001	1	2DD DISK ASSY ENCYCLOPEDIA 1 WP-2450DS	
11	UA8725001	1	2DD DISK ASSY ENCYCLOPEDIA 2 WP-2450DS	
11	UA8727001	1	2DD DISK ASSY ENCYCLOPEDIA 3 WP-2450DS	
11	UA8729001	1	2DD DISK ASSY ENCYCLOPEDIA 4 WP-2450DS	
11	UA8731001	1	2DD DISK ASSY ENCYCLOPEDIA 5 WP-2450DS	

53V-311-302

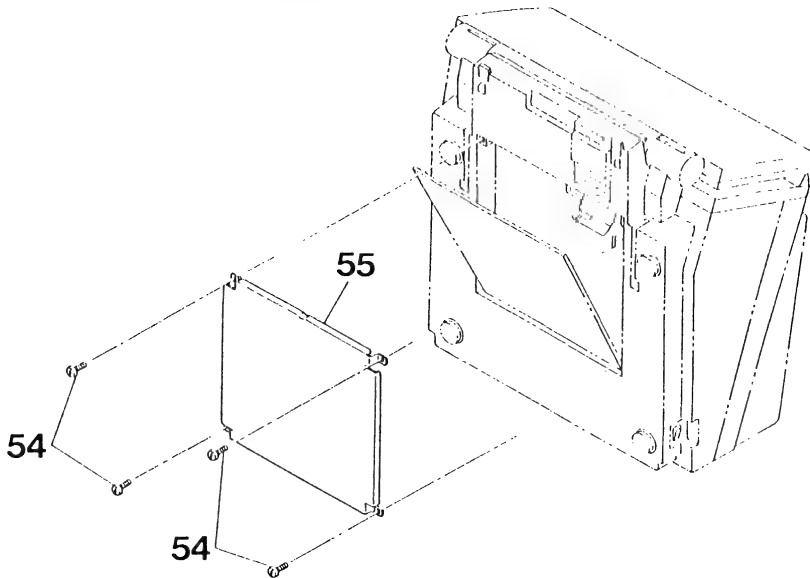
12. COVER



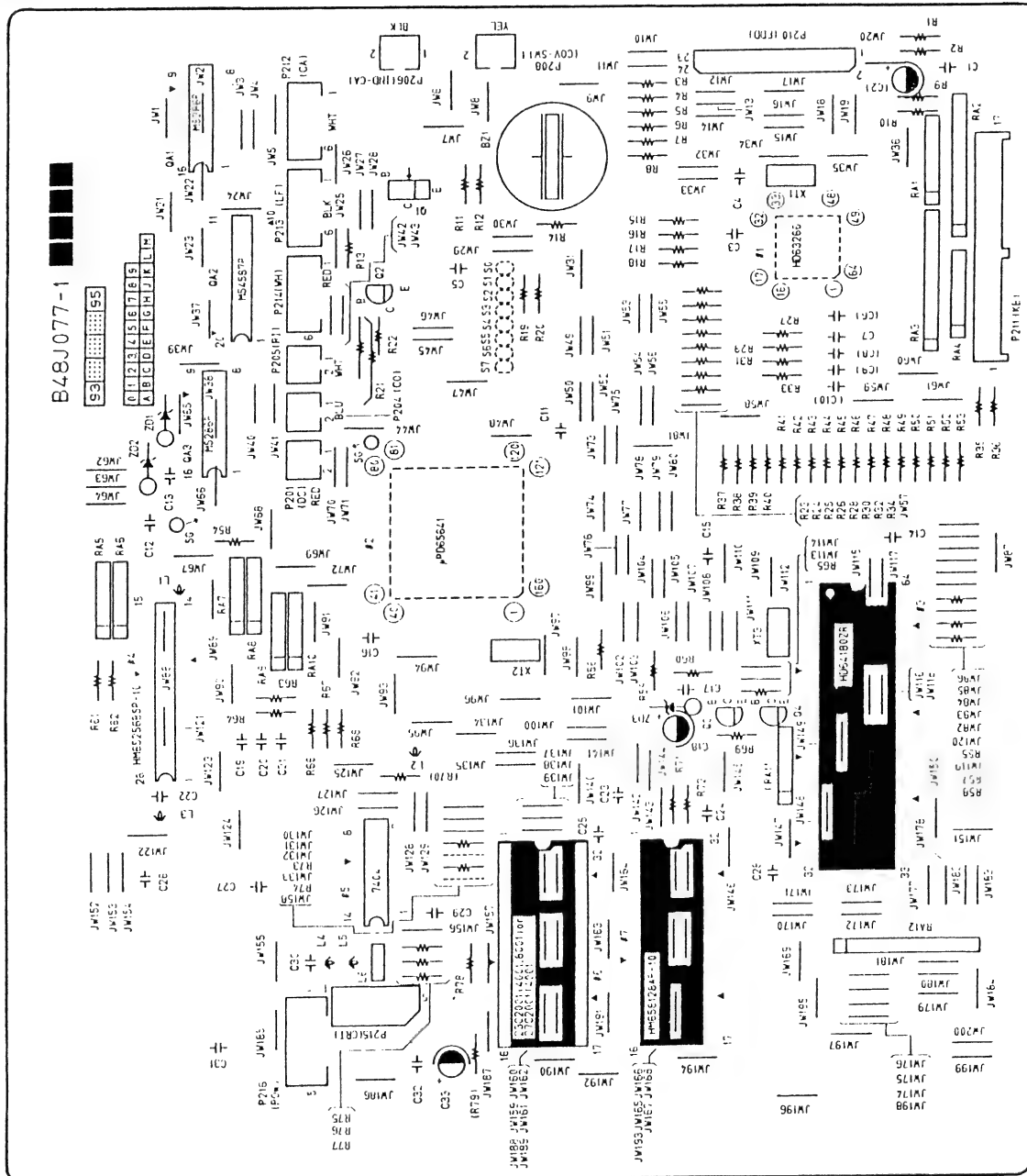
12. COVER

REF.NO.	CODE	Q'TY	DESCRIPTION	REMARKS
1-3	UA4630011	1	BOTTOM COVER ASSY L, GRAY738	
1	UA4631011	1	BOTTOM COVER L, GRAY738	
2	UA4632011	1	HANDLE, GRAY738	
3	U78048001	4	RUBBER FOOT	
4-5	UA8712011	1	FRONT PANEL ASSY H	
4	UA8713011	1	FRONT PANEL H	
5	W01243001	1	LED LENS	
6	U08740001	4	TAPTITE, BIND B M4X12	
7	UA2149011	1	BODY COVER, GRAY738	
8	U78141001	2	TAPTITE, BIND B M4X20	
9	UA4641011	1	BODY COVER BLIND PANEL, GRAY738	
10	UA4643001	1	TOP COVER L, GRAY 1186	
11	UA2151011	1	PAPER SUPPORT, GRAY738	
12	U78059011	1	PAPER GUIDE, GRAY738	
13	UA8492001	1	CRT BLINDER	
14	UA3974000	1	GROUND PLATE	
15	UA2183011	1	PAPER REST, GRAY738	
16	UA2195008	2	TILT PLATE SPACER, GRAY1162	
17	UA2031001	1	VIBROISOLATING SHEET	
18	U05404001	1	TAPTITE, BIND B M3X8	
19	UA7632001	1	FCC LABEL	
20	UA4648001	1	ATTENTION LABEL	
21	UA8714001	1	FEATURE/DEMO LABEL	
22	UA8715001	1	S FEATURE/DEMO LABEL	
23	UA8716001	1	RATING LABEL, WP2450DS UL	

13. MAIN PCB ASSEMBLY



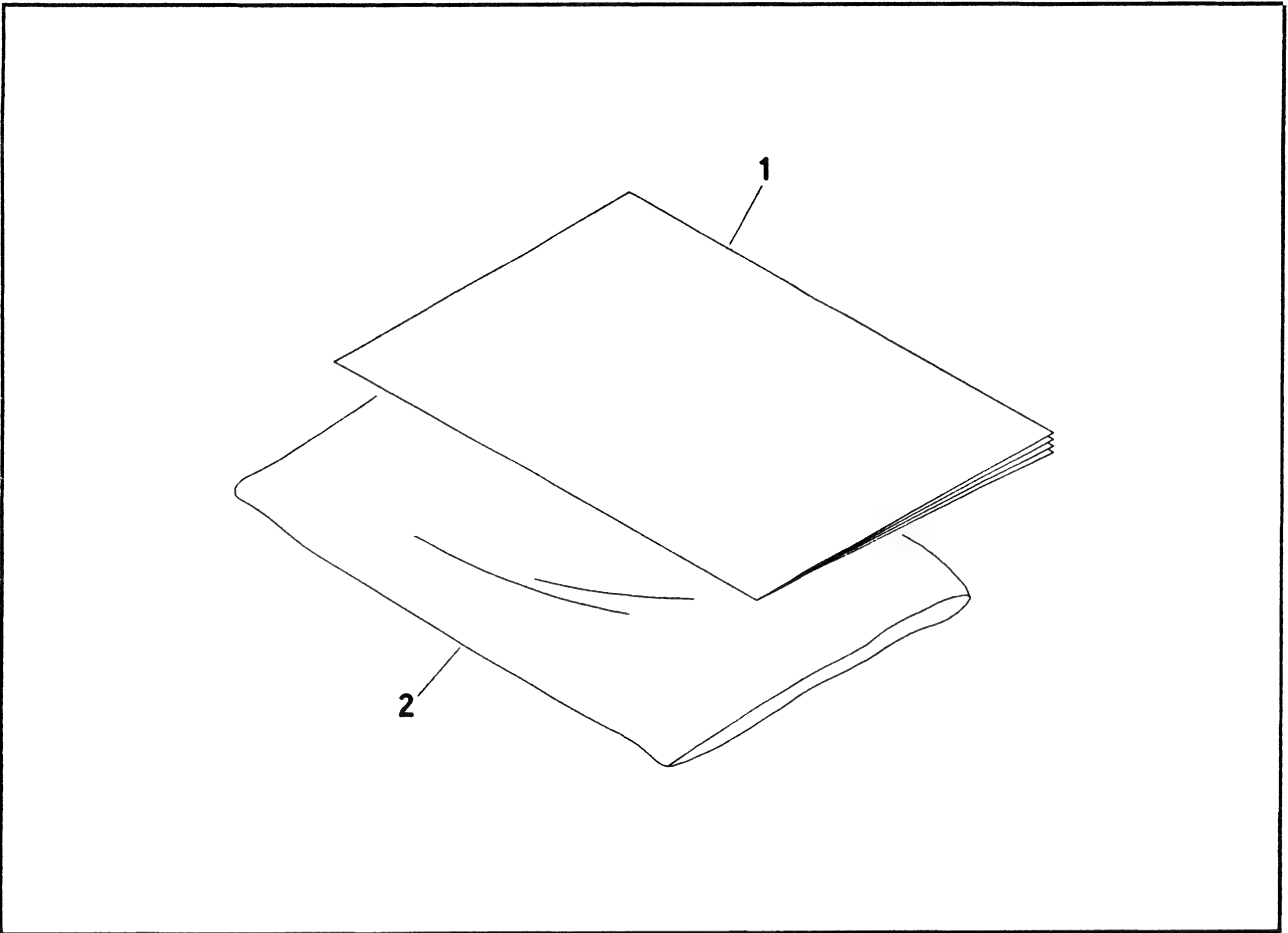
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13. MAIN PCB ASSEMBLY

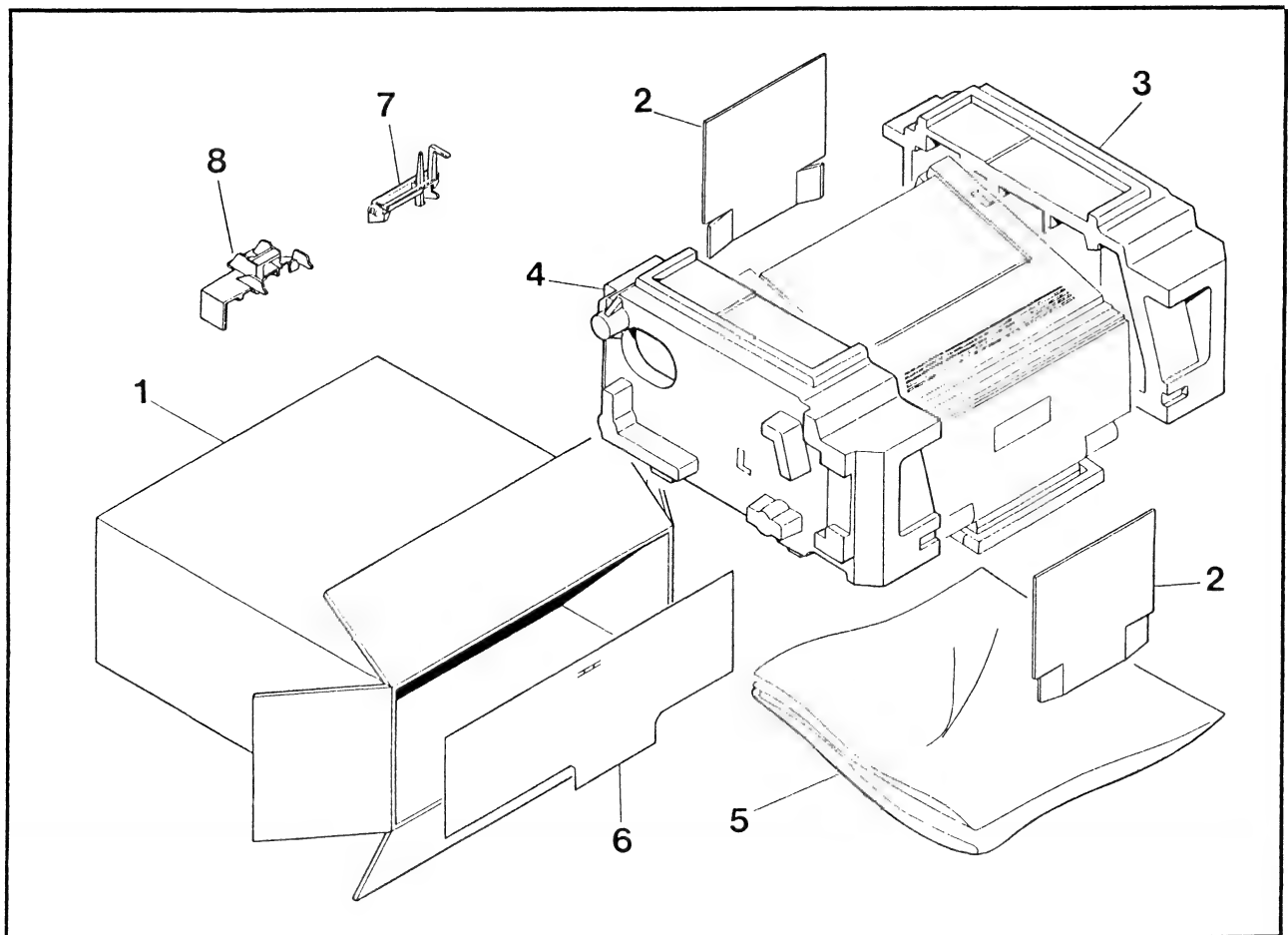
REF.NO.	SYMBOL	CODE	Q'TY	DESCRIPTION	RMKS
1-53	B48J077-101	UA8733001	1	MAIN PCB ASSY A-1 (SP) USA. ENGLISH	
1	#3	UC3636000	1	MPU:HD64180ZR	
2	#6	UA8504001	1	LSI:HN62314BPG24 US	
3	#6	U18265000	1	IC SOCKET:ICC05-032-360TP	
4	#4	UA6228000	1	PSEUDO SRAM:HM65256BSP10	
5	#7	U38077000	1	PSEUDO SRAM:658128AL10	
6	#1	UC2835000	1	LSI:HD63266F	
7	#2	UA8602000	1	GATE ARRAY:UPD65641-036	
8	#5	UA6350000	1	IC:7404	
9	QA2	UA5454000	1	TRANSISTOR AR:M54587P	
10	QA1,3	U17826000	2	TRANSISTOR AR:M5286P	
11	Q2	U16774000	1	TRANSISTOR, :2SA1282A-FG	
12	Q1	U34923000	1	TRANSISTOR, :UN4211	
13	Q3,4	U15058000	2	TRANSISTOR, :2SC2603	
14	XT3	U78209000	1	CERAMIC OSCILLATOR, CST12.2MT	
15	XT2	UA6229000	1	CERAMIC OSCILLATOR:CST15.33MX	
16	XT1	UA6253000	1	CERAMIC OSCILLATOR:CST16M2C3	
17	ZD1,2	UA6206000	2	DIODE, ZENER:MTZ15C	
18	ZD3	UA6230000	1	DIODE, ZENER:HZ9B1L	
19	L3	UC1772000	2	COIL:SBT-0210	
20	L2,4,5	U78267000	3	COIL:SBT-0440	
21	L6	UA1734000	1	FILTER:2R2-101	
22	BZ1	132613001	1	BUZZER:PKM24	
23	C7	Y16802001	1	CAPACITOR, CERAMIC 50B680	
24	C22	Y21042421	1	CAPACITOR, CERAMIC 50B104	
25	C.1,3,4,5, 11,12,14,15, 16,17,23,24, 25,26,28,29, 31,32	U10389000	18	CAPACITOR, CERAMIC 25B104Z-249	
26	C18	Y41012602	1	CAPACITOR, ALUM-ELEC 16B101	
27	C33	Y41011602	1	CAPACITOR, ALUM-ELEC 10B101VS	
28	R23,24,25, 26,28,30,32, 34,61,62,66, 67,68	090101120	13	FIXED RESISTOR, D-A14YJ101	
29	R14	090471120	1	FIXED RESISTOR, D-A14YJ471	
30	R17,18,27, 29,31,33,54, 55,56,57,63, 64,71,72,78	090221120	15	FIXED RESISTOR, D-A14YJ221	
31	R3,4,5,6,7, 8,13,19,20, 65,73,74,77	090102120	13	FIXED RESISTOR, D-A14YJ102	
32	R59	090152120	1	FIXED RESISTOR, D-A14YJ152	
33	R37,38,39, 40,41,42,43, 44,45,69	090222120	10	FIXED RESISTOR, D-A14YJ222	
34	R11,12,58	090472120	3	FIXED RESISTOR, D-A14YJ472	
35	R22,46,47, 48,49,50,51, 52,53,60,75, 76	090103120	12	FIXED RESISTOR, D-A14YJ103	
36	R15,16,35,36	090104120	4	FIXED RESISTOR, D-A14YJ104	
37	R21	Y01000613	1	FIXED RESISTOR, GR-A2YJ101	
38	RA4	Y61046041	1	RESISTOR ARRAY, J104X6	
39	RA5,6	Y61013061	2	RESISTOR ARRAY, 101Y3J	
40	RA12	Y62218662	1	RESISTOR ARRAY, 221Y8 S	
41	RA7,8,9,10	Y62213061	4	RESISTOR ARRAY, 221Y3	
42	P205	U17118000	1	CONNECTOR:B2B-PH	
43	P201	U17118001	1	CONNECTOR:B2B-PH	
44	P206	U17118002	1	CONNECTOR:B2B-PH	
45	P204	U17118003	1	CONNECTOR:B2B-PH	
46	P208	U17118004	1	CONNECTOR:B2B-PH	
47	P216	UA6238000	1	CONNECTOR:B5B-XH-A	
48	P215	U15276000	1	CONNECTOR:5267-05A	
49	P212	U17119000	1	CONNECTOR:B6B-PH	
50	P214	U17119001	1	CONNECTOR:B6B-PH	
51	P213	U17119002	1	CONNECTOR:B6B-PH	
52	P210	UA7729000	1	CONNECTOR:9603S-24A	
53	P211	UA3044000	1	CONNECTOR:5229-17CPB	
54		UA8522000	4	TAPTITE, BIND B M3X12	
55		UA4674000	1	BOTTOM PLATE	

14. PRINTED MATTER



53V-311-920

15. PACKING MATERIALS



53V-311-930

14. PRINTED MATTER

REF.NO.	CODE	Q'TY	DESCRIPTION	REMARKS
1	592311061	1	USER'S MANUAL, USA. ENGLISH WP-2450DS	
1	592311001	1	USER'S MANUAL ENCYCLOPEDIA	
2	UA7282001	1	PERFORATED BAG	

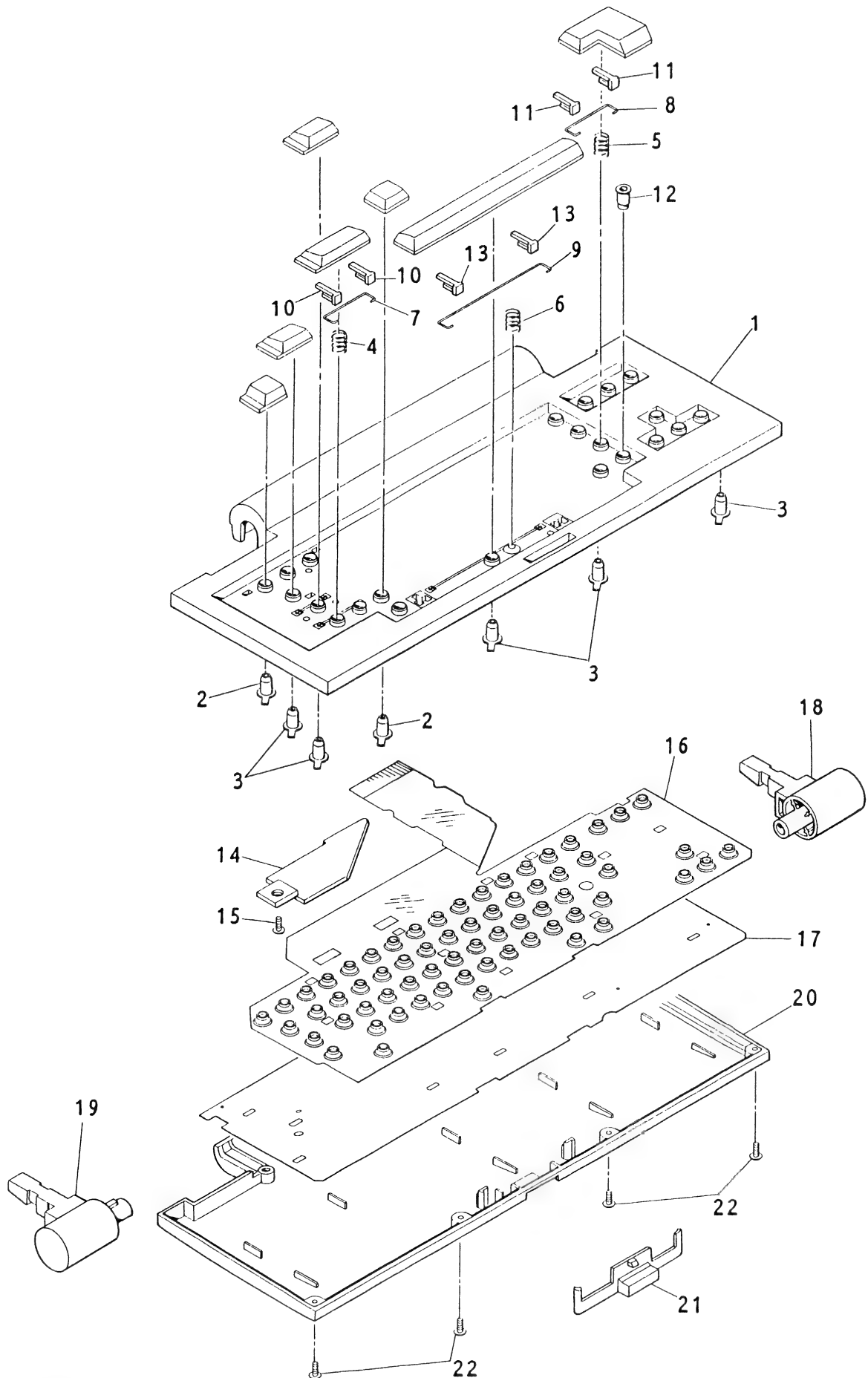
53V-311-920

15. PACKING MATERIALS

REF.NO.	CODE	Q'TY	DESCRIPTION	REMARKS
1	U62044021	1	CARTON NO BRAND	
1	U62383022	1	CARTON	
2	U61191000	2	PARTITION	
3	U62047001	1	STYROFOAM PAD R	
4	U62048001	1	STYROFOAM PAD L	
5	UA7284001	1	PERFORATED BAG	
6	U61790000	1	KB PROTECT SHEET	
7	U61729001	1	CARRIAGE STOPPER3V-201	
8	U62050001	1	RIBBON CASSETTE STOPPER3V-301	

53V-311-930

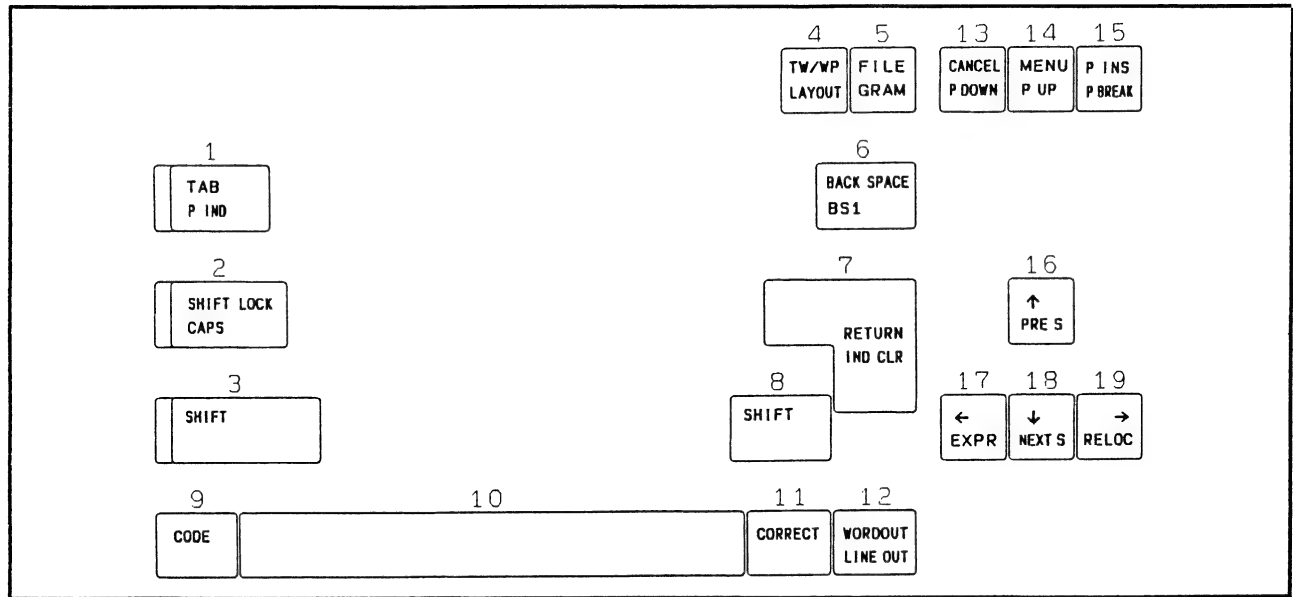
16.1. KEYBOARD MECHANISM/USA.English



16.1. KEYBOARD MECHANISM/USA.ENGLISH

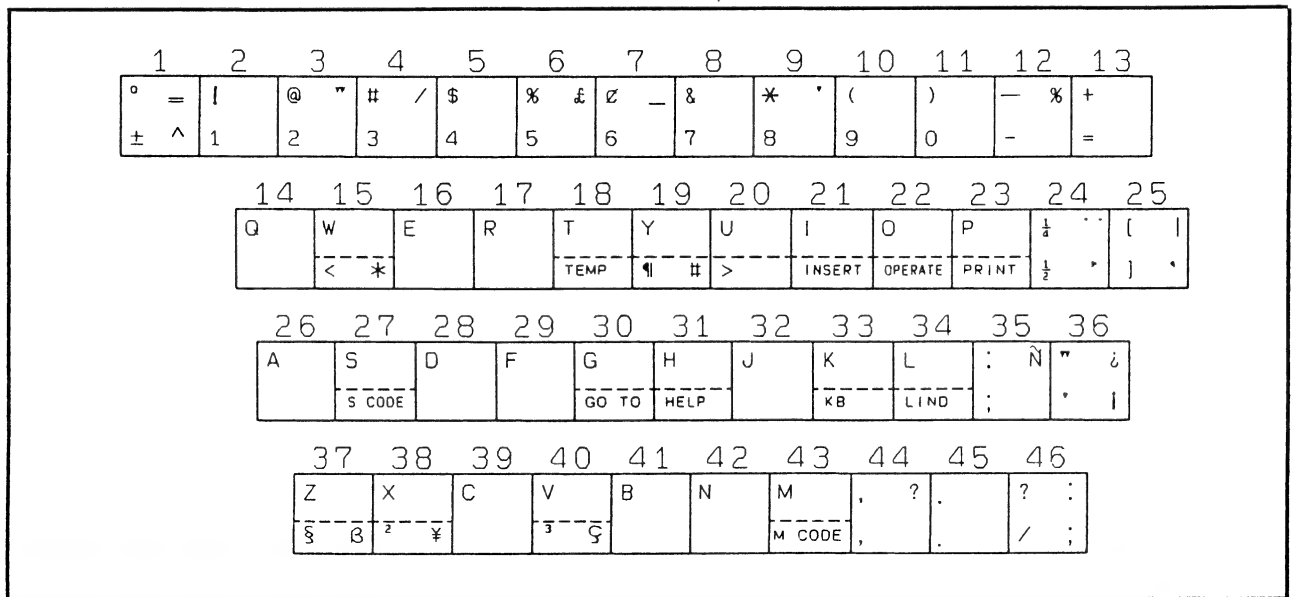
REF.NO.	CODE	Q'TY	DESCRIPTION	REMARKS
1	UA4662011	1	KB UPPER COVER, GRAY738	
2	U11350000	46	KEY STEM	
3	U11350000	19	KEY STEM	
4	539211001	1	SPRING, COMPRESSION M10.85X19	
5	539211001	1	SPRING, COMPRESSION M10.85X19	
6	U08599001	1	SPRING, COMPRESSION M11X19	
7	U09006000	1	WIRE, 38X9.8	
8	U09006000	1	WIRE, 38X9.8	
9	UA0206000	1	WIRE, 95X9.8	
10	U51457001	2	711 WIRE GUIDE	
11	U51457001	2	711 WIRE GUIDE	
12	U11777001	1	SUB STEM GUIDE #4	
13	U51457001	2	711 WIRE GUIDE	
14	UA4664013	1	FPC HOLDER, WHITE1138	
15	U06923001	1	TAPTITE, BIND B M3X10	
16	UA4665001	1	FPC ASSY	
17	UA4667000	1	BASE PLATE	
18	UA4668011	1	KB TILT ARM R, GRAY738	
19	UA4669011	1	KB TILT ARM L, GRAY738	
20	UA4670011	1	KB LOWER COVER, GRAY738	
21	UA4671011	1	KB LOCK	
22	U05404001	6	TAPTITE, BIND B M3X8	

16.2. FUNCTION KEYS/USA.ENGLISH



53V-311-202

16.3. CHARACTER KEYS/USA.ENGLISH



53V-311-202

16.2. FUNCTION KEYS/USA.ENGLISH

REF.NO.	CODE	Q'TY	DESCRIPTION	REF.NO.	CODE	Q'TY	DESCRIPTION
1	U75115078	1	TAB/P IND KEY	25	U09006000	1	WIRE, 38X9.8
2	UA0201078	1	SHIFT LOCK/CAPS KEY	26	U09006000	1	WIRE, 38X9.8
3	U11356077	1	SHIFT KEY	27	UA0206000	1	WIRE, 95X9.8
4	UA5512078	1	TW/WP/LAYOUT KEY	28	U51457001	2	711 WIRE GUIDE
5	UA5513078	1	FILE/GRAM KEY	29	U51457001	2	711 WIRE GUIDE
6	U12875078	1	BACK SPACE/BS1 KEY	30	U11777001	1	SUB STEM GUIDE #4
7	U78091078	1	RETURN/IND CLR KEY	31	U51457001	2	711 WIRE GUIDE
8	U05982077	1	SHIFT KEY				
9	U78005078	1	CODE KEY				
10	UA0302077	1	SPACE KEY				
11	U11367077	1	CORRECT KEY				
12	UA3230078	1	WORD OUT/LINE OUT KEY				
13	UA5514078	1	CANCEL/P DOWN KEY				
14	UA5515078	1	MENU/P UP KEY				
15	U78009078	1	P INS/PBREAK KEY				
16	UA5516078	1	UP/PRE S KEY				
17	UA5517078	1	LEFT/EXPR KEY				
18	UA5518078	1	DOWN/NEXTS KEY				
19	UA5519078	1	RIGHT/RELOC KEY				
20	U11350000	46	KEY STEM				
21	U11350000	19	KEY STEM				
22	539211001	1	SPRING, COMPRESSION M10.85X19				
23	539211001	1	SPRING, COMPRESSION M10.85X19				
24	U08599001	1	SPRING, COMPRESSION M11X19				

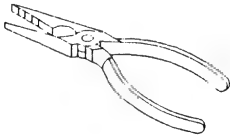
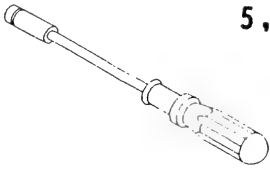
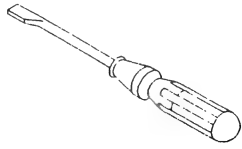
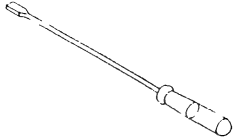
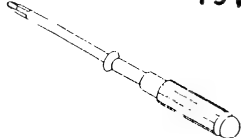
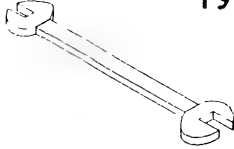
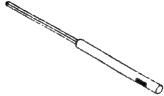
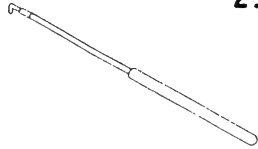
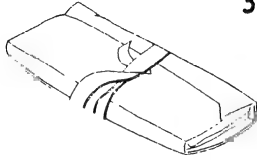
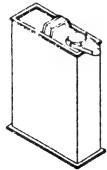
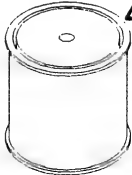
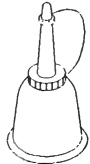
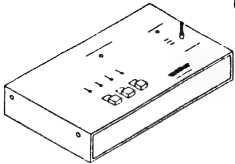

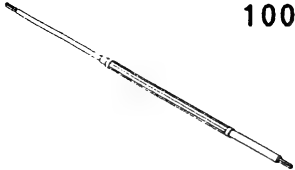
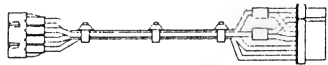
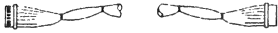
53V-311-202

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53V-311-202

17. ADJUSTING TOOL KIT

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 <p>42-G</p>	 <p>43-A, B, D</p>	 <p>44</p>
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17. ADJUSTING TOOL KIT

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INDEX

CODE	REF.NO.	PAGE
UA0201078	16.2 - 2	26
UA0206000	16.1 - 9	24
	16.2 - 27	26
UA0302077	16.2 - 10	26
UA0321077	16.3 - 29	26
UA0322077	16.3 - 32	26
UA1683001	9 - 1-88A	12
UA1701001	7 - 1-2	8
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UA1703001	7 - 1-2	8
UA1704001	7 - 1-2	8
UA1705001	7 - 1-2	8
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UA1708001	7 - 1-2	8
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UA1711001	7 - 1-2	8
UA1734000	13 - 21	20
UA1819001	8 - 31	10
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UA2031001	12 - 18	18
UA2149011	12 - 7	18
UA2151011	12 - 11	18
UA2153000	12 - 14	18
UA2159000	10 - 29	16
UA2160001	3 - 45	4
UA2161001	6 - 1	8
UA2183011	12 - 16	18
UA2189001	3 - 4	4
UA2195008	12 - 17	18
UA2200001	10 - 32	16
UA2202001	10 - 28	16
UA2218002	1 - 1	2
UA2221001	1 - 3	2
UA2222001	1 - 16	2
UA2321011	9 - 89	13
UA2321015	9 - 89	13
UA2321021	9 - 89	13
UA2321022	9 - 89	13
UA2322000	9 - 92	13
UA2323008	7 - 4	8
UA2325000	10 - 18	16
UA2428000	9 - 6	12
UA2429000	9 - 12	12
UA2430000	9 - 37	12
UA2431000	9 - 41	12
UA2432000	9 - 64	12
UA2434000	9 - 82	13
UA2437001	9 - 88	13
UA2442000	9 - 35	12
UA2443000	9 - 36	12
UA2446000	9 - 76	12
UA2447000	9 - 85	13
UA2448000	7 - 2	8
UA2449000	7 - 2	8
UA2450000	7 - 2	8
UA2451001	7 - 1	8
UA2452001	7 - 1	8
UA2453001	7 - 1	8
UA2454001	7 - 1	8
UA2455001	7 - 1	8
UA2456001	7 - 1	8
UA2459000	4 - 1	6
UA2460000	4 - 1	6
UA2461000	4 - 1	6
UA2462000	4 - 1	6
UA2463000	4 - 1	6

CODE	REF.NO.	PAGE
UA2464000	4 - 1	6
UA2465000	4 - 1	6
UA2467000	4 - 1	6
UA2601001	2 - 2	2
UA2602011	2 - 4	2
UA2602021	2 - 4	2
UA2603001	2 - 5	2
UA2605011	2 - 8	2
UA2605021	2 - 8	2
UA2606001	2 - 9	2
UA2617001	10 - 17	16
UA2619001	10 - 2-4	16
UA2620000	10 - 2	16
UA2621000	10 - 3	16
UA2622000	10 - 4	16
UA2623000	10 - 13	16
UA2624001	10 - 21	16
UA2625000	10 - 22	16
UA2628000	10 - 25	16
UA2629008	10 - 26	16
UA2630008	10 - 27	16
UA2634001	3 - 10-19	4
UA2635001	3 - 13	4
UA2637001	3 - 37	4
UA2638001	3 - 38	4
UA2639001	3 - 51	4
UA2643001	3 - 47	4
UA2658001	9 - 1-88A	12
UA2666001	9 - 1-88	12
UA2684001	7 - 1-2	8
UA2695001	8 - 1-36	10
UA3044000	13 - 53	20
UA3230078	16.2 - 12	26
UA3270002	1 - 1-18	2
UA3537001	9 - 84-86	13
UA3538001	9 - 84	13
UA3585001	7 - 1-2	8
UA3974000	12 - 15	18
UA4215000	3 - 2	4
UA4224001	3 - 20	4
UA4500001	3 - 48	4
UA4630011	12 - 1-3	18
UA4631011	12 - 1	18
UA4632011	12 - 2	18
UA4641011	12 - 9	18
UA4643001	12 - 10	18
UA4648001	12 - 21	18
UA4662011	16.1 - 1	24
UA4664013	16.1 - 14	24
UA4665001	16.1 - 16	24
UA4667000	16.1 - 17	24
UA4668011	16.1 - 18	24
UA4669011	16.1 - 19	24
UA4670011	16.1 - 20	24
UA4671011	16.1 - 21	24
UA4674000	13 - 55	20
UA4677001	3 - 36-38	4
UA4784001	7 - 4	8
UA4786001	3 - 43	4
UA5454000	13 - 9	20
UA5458001	7 - 1	8
UA5501078	16.3 - 18	26
UA5502078	16.3 - 21	26
UA5503078	16.3 - 22	26
UA5504078	16.3 - 23	26
UA5507078	16.3 - 30	26
UA5508078	16.3 - 31	26

INDEX

CODE	REF.NO.	PAGE
UA5509078	16.3 - 33	26
UA5510078	16.3 - 34	26
UA5511078	16.3 - 43	26
UA5512078	16.2 - 4	26
UA5513078	16.2 - 5	26
UA5514078	16.2 - 13	26
UA5515078	16.2 - 14	26
UA5516078	16.2 - 16	26
UA5517078	16.2 - 17	26
UA5518078	16.2 - 18	26
UA5519078	16.2 - 19	26
UA6203000	8 - 4	10
UA6204000	8 - 5	10
UA6205000	8 - 9	10
UA6206000	8 - 10	10
	13 - 17	20
UA6207000	8 - 27	10
UA6208001	8 - 30	10
UA6210000	8 - 33	10
UA6213001	8 - 1-36	10
UA6228000	13 - 4	20
UA6229000	13 - 15	20
UA6230000	13 - 18	20
UA6238000	13 - 47	20
UA6253000	13 - 16	20
UA6348000	7 - 2	8
UA6350000	13 - 8	20
UA7282001	14 - 2	22
UA7284001	15 - 5	22
UA7369000	10 - 23	16
UA7524001	11 - 4	16
UA7632001	12 - 20	18
UA7645001	1 - 6	2
UA7721000	9 - 75	12
UA7722000	9 - 74	12
UA7723000	9 - 73	12
UA7724000	9 - 72	12
UA7729000	13 - 52	20
UA8490119	16.3 - 1-46	26
UA8492001	12 - 13	18
UA8504001	13 - 2	20
UA8522000	13 - 54	20
UA8602000	13 - 7	20
UA8705011	11 - 1	16
UA8706011	11 - 2	16
UA8712011	12 - 4-5	18
UA8713011	12 - 4	18
UA8714001	12 - 22	18
UA8715001	12 - 23	18
UA8716001	12 - 24	18
UA8717000	11 - 6	16
UA8718000	11 - 3	16
UA8719001	11 - 8	16
UA8721001	11 - 9	16
UA8723001	11 - 10	16
UA8725001	11 - 10	16
UA8727001	11 - 10	16
UA8729001	11 - 10	16
UA8731001	11 - 10	16
UA8733001	13 - 1-53	20
UA8735011	11 - 1-3	16
UC0104000	9 - 5	12
UC0109000	9 - 7	12
UC0113000	9 - 81	13
UC0141000	9 - 8	12
UC0281000	9 - 16	12
UC1314000	8 - 7	10

CODE	REF.NO.	PAGE
UC1772000	13 - 19	20
UC1840000	8 - 35	10
UC2835000	13 - 6	20
UC3636000	13 - 1	20
U02021001	3 - 46	4
U02082001	9 - 90	13
U02719001	1 - 12	2
U02720001	1 - 11-12	2
U02926001	3 - 21	4
U05404001	7 - 6	8
	8 - 37	10
	12 - 19	18
	16.1 - 22	24
U05656001	2 - 10	2
U05906001	3 - 5	4
U05982077	16.2 - 8	26
U06775001	1 - 17	2
U06776001	1 - 18	2
U06824001	10 - 7	16
U06923001	8 - 34	10
	16.1 - 15	24
U06958001	10 - 10	16
U08509001	1 - 7	2
U08510001	1 - 10	2
U08513001	1 - 2	2
U08575001	10 - 5	16
U08599001	16.1 - 6	24
	16.2 - 24	26
U08629001	3 - 8	4
U08632001	3 - 53	4
U08637001	3 - 57	4
U08642001	3 - 12	4
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U08671001	3 - 58	4
U08740001	4 - 2	6
	10 - 24	16
	12 - 6	18
U08858001	3 - 7	4
U09006000	16.1 - 7	24
	16.1 - 8	24
	16.2 - 25	26
	16.2 - 26	26
U09759001	3 - 52	4
	11 - 5	16
U10389000	8 - 12	10
	13 - 25	20
U10435000	8 - 15	10
U11209000	1 - 5	2
U11211001	1 - 8	2
U11212000	1 - 9	2
U11213002	1 - 14	2
U11217001	2 - 1	2
U11231000	2 - 11	2
U11232001	2 - 12	2
U11242001	10 - 1	16
U11244001	10 - 6	16
U11246001	10 - 7-9	16
U11247001	10 - 8	16
U11248001	10 - 12	16
U11251000	10 - 15	16
U11256001	10 - 19	16
U11258001	3 - 1	4
U11274002	3 - 53-57	4
U11277001	3 - 54	4
U11280001	3 - 16	4
U11281001	3 - 55	4
U11283000	3 - 11	4

INDEX

CODE	REF.NO.	PAGE	CODE	REF.NO.	PAGE
U11285000	3 - 14	4	U51457001	16.2 - 29	26
U11286000	3 - 17	4		16.2 - 31	26
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U11293000	3 - 23	4	U61729001	15 - 7	22
U11294001	3 - 25	4	U61790000	15 - 6	22
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U11298000	3 - 28	4	U62047001	15 - 3	22
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U11302001	3 - 33	4	U75115078	16.2 - 1	26
U11303001	3 - 34	4	U78005078	16.2 - 9	26
U11311001	3 - 40	4	U78009078	16.2 - 15	26
U11312000	3 - 59	4	U78048001	12 - 3	18
U11313000	3 - 41	4	U78059011	12 - 12	18
U11314001	3 - 42	4	U78091078	16.2 - 7	26
U11350000	16.1 - 2	24	U78141001	12 - 8	18
	16.1 - 3	24	U78209000	13 - 14	20
	16.2 - 20	26	U78267000	13 - 20	20
	16.2 - 21	26	U78326000	9 - 10	12
U11356077	16.2 - 3	26	U78328000	9 - 3	12
U11367077	16.2 - 11	26	U78330000	9 - 4	12
U11383078	16.3 - 27	26	U78350000	9 - 67	12
U11500001	10 - 20	16	U78351000	9 - 66	12
U11776001	3 - 44	4	U78352000	9 - 63	12
	5 - 2	6	U78353000	9 - 65	12
	11 - 7	16	U78354000	9 - 71	12
U11777001	16.1 - 12	24	U78356000	9 - 77	12
	16.2 - 30	26	U78357000	9 - 78	12
U11804001	3 - 36	4	U78365000	9 - 79	12
U12875078	16.2 - 6	26	U78366000	9 - 14	12
U15058000	13 - 13	20	U78367000	9 - 13	12
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U16194000	9 - 80	12	U78384000	9 - 39	12
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U17826000	13 - 10	20	Y16802001	13 - 23	20
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U18078000	8 - 29	10	Y41002001	9 - 19	12
U18265000	13 - 3	20	Y41002002	8 - 17	10
U18267000	8 - 18	10	Y41005602	8 - 20	10
U18504001	3 - 22	4	Y41006001	9 - 26	12
U18552001	3 - 6	4	Y41011601	8 - 16	10
U32795001	8 - 8	10	Y41011602	13 - 27	20
U34923000	13 - 12	20	Y41012602	13 - 26	20
U38077000	13 - 5	20	Y41016001	9 - 27	12
U50429077	16.3 - 2	26	Y41021001	9 - 18	12
U50431077	16.3 - 14	26	Y41022001	9 - 23	12
U51317077	16.3 - 1	26	Y42212001	9 - 20	12
U51457001	16.1 - 10	24	Y42222001	8 - 19	10
	16.1 - 11	24		9 - 24	12
	16.1 - 13	24	Y43300001	9 - 17	12
	16.2 - 28	26	Y43312001	9 - 21	12

INDEX

CODE	REF.NO.	PAGE	CODE	REF.NO.	PAGE
Y44712001	9 - 22	12	090751110	8 - 22	10
Y44793001	9 - 25	12	090820120	9 - 45	12
Y51020000	9 - 29	12	132613001	13 - 22	20
Y51030000	9 - 30	12	136345001	8 - 2	10
Y51530000	9 - 31	12	502673001	9 - 91	13
Y51830000	9 - 32	12		10 - 31	16
Y52230000	9 - 33	12	519475002	10 - 30	16
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Y61013061	13 - 39	20	529545001	9 - 86	13
Y61046041	13 - 38	20		9 - 87	13
Y62213061	13 - 41	20	535151001	9 - 83	13
Y62218662	13 - 40	20	536933001	1 - 4	2
Z24385001	5 - 3	6	539211001	16.1 - 4	24
Z24393001	5 - 1	6		16.1 - 5	24
021300205	3 - 26	4		16.2 - 22	26
	3 - 50	4		16.2 - 23	26
021350106	10 - 11	16	542302001	1 - 11	2
021350206	3 - 56	4	571672001	3 - 3	4
026030136	3 - 10	4		3 - 39	4
037301615	7 - 5	8	571852001	7 - 3	8
048020346	1 - 13	2	583241077	16.3 - 5	26
	3 - 19	4	583244077	16.3 - 8	26
	3 - 29	4	583246077	16.3 - 10	26
	3 - 35	4	583247077	16.3 - 11	26
048030346	1 - 19	2	583249077	16.3 - 13	26
	3 - 9	4	583259077	16.3 - 16	26
	10 - 9	16	583260077	16.3 - 17	26
048040346	2 - 3	2	583273077	16.3 - 26	26
	2 - 6	2	583275077	16.3 - 28	26
062260406	5 - 4	6	583290077	16.3 - 39	26
062300506	1 - 15	2	583292077	16.3 - 41	26
	3 - 24	4	583293077	16.3 - 42	26
	8 - 38	10	583306077	16.3 - 3	26
	10 - 14	16	583307077	16.3 - 4	26
	10 - 16	16	583308077	16.3 - 6	26
062350605	3 - 60	4	583309077	16.3 - 7	26
090101120	9 - 46	12	583310077	16.3 - 9	26
	13 - 28	20	583311077	16.3 - 12	26
090102120	13 - 31	20	583313078	16.3 - 15	26
090103120	9 - 54	12	583314078	16.3 - 19	26
	13 - 35	20	583315078	16.3 - 20	26
090104120	13 - 36	20	583316077	16.3 - 24	26
090122620	9 - 42	12	583317077	16.3 - 25	26
090144120	9 - 60	12	583321077	16.3 - 35	26
090152120	13 - 32	20	583322077	16.3 - 36	26
090153120	8 - 25	10	583328078	16.3 - 37	26
	9 - 55	12	583329078	16.3 - 38	26
090183120	9 - 56	12	583330078	16.3 - 40	26
090202120	9 - 48	12	583331077	16.3 - 44	26
090221120	9 - 47	12	583332077	16.3 - 45	26
	13 - 30	20	583333077	16.3 - 46	26
090222120	13 - 33	20	592311001	14 - 1	22
090242120	9 - 49	12	592311061	14 - 1	22
090273120	9 - 57	12			
090332120	8 - 26	10			
	9 - 50	12			
090333120	9 - 58	12			
090470120	9 - 44	12			
090471120	13 - 29	20			
090472120	9 - 51	12			
	13 - 34	20			
090474120	9 - 61	12			
090479120	9 - 43	12			
090561110	8 - 23	10			
090562120	9 - 52	12			
090682120	9 - 53	12			
090683120	9 - 59	12			

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